

Supplemental Material

Supplemental Methods

Relationship between α and price elasticity of demand

In economics, a commonly used measure of price sensitivity is the price elasticity of demand, defined as the relative change in demand per unit relative change in price. To compute the price elasticity in our model, we first normalize the consumption between its maximum and minimum values:

$$q = \frac{Q - Q_{min}}{Q_{max} - Q_{min}} = e^{-\alpha C}$$

The normalized consumption q scales between 1 (maximum consumption) and 0 (minimum consumption). Next, we compute the price elasticity of demand for the normalized consumption:

$$E = \frac{dq/q}{dC/C} = -\alpha/C$$

which gives us the following useful relationship: α is the cost at which the elasticity of demand is exactly -1, meaning the normalized consumption drops by one percent in response to a one percent increase in price.

Additional supplemental methods

Acquisition of Sucrose Maintained Responding

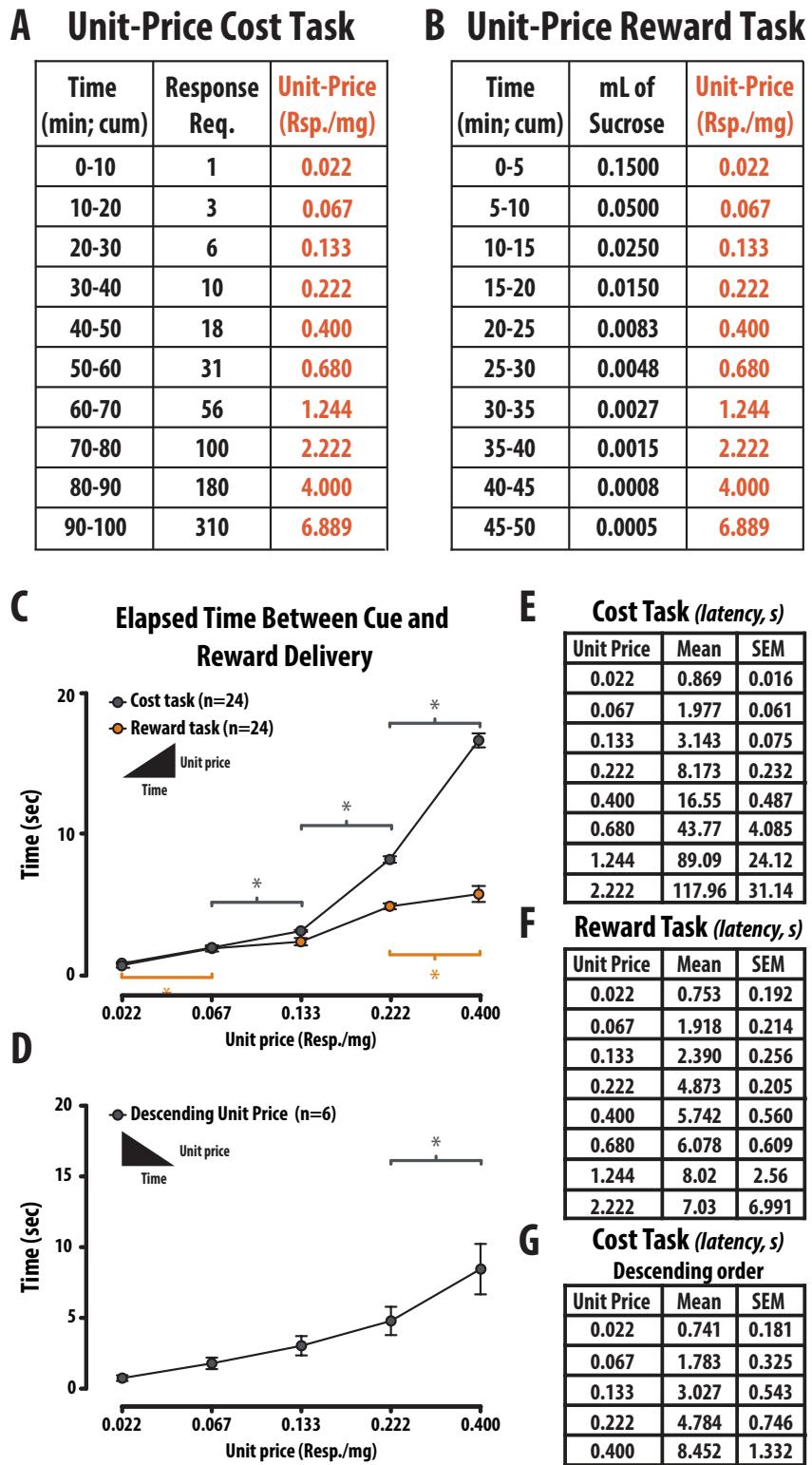
Upon recovery from surgery, animals were trained daily (7d/wk) in operant boxes (Med-Associates) enclosed within sound-attenuated chambers to respond on a lever for sucrose pellets (45mg dustless precision pellets, Bio-Serv). Animals were first shaped by the experimenter; acquisition of sucrose maintained responding was defined as the first day animals reached 30 reinforced responses independent of experimenter interaction. Animals were then assigned to either begin in the effort or magnitude version of our behavioral economics based sucrose task according to a within-subject, counter-balanced design. Prior to initiating stimulation sessions, we first determined stable baseline values in the behavioral economic task. Stable baseline was defined by animals stopping within a range of three epochs with no ascending or descending trend for three consecutive days.

Histology and Immunohistochemistry

At the end of experimentation rats were placed under deep anesthesia using a ketamine/xylazine solution (100mg/kg; 20mg/kg, respectively) and transcardially perfused using ice-cold 0.01M PBS followed by 4% paraformaldehyde. Brains were removed and submerged in 4% paraformaldehyde for 24 hours followed by 30% sucrose for >48 hours at 4°C. Brains were then frozen at -80°C and sectioned coronally at 50 µm on a cryostat. When immunohistochemistry was required, free-floating tissue was incubated with 15% Normal Donkey serum in 0.01 M PBS for 24 hours at 4°C. Tissue was washed with Tween 20 (1:1000) in PBS followed by washes with only PBS (x3). Tissue was incubated for 48 hours in Immunostar

Tyrosine Hydroxylase primary antibody (1:1000) at 4°C and washed as above. Tissue was then incubated overnight in 2mg/mL Alexafluor647 donkey ant-mouse IgG secondary antibody in 0.1M PBS (1:1000) at 4°C followed by the same series of washes. Sections were mounted with Vector Vectashield hardset mounting media with DAPI. Brains were removed and sectioned (50µm coronal slices) using a cryostat, cryoprotected and mounted for microscopy. When relevant, microelectrode placement was determined by performing electrolytic lesions of recording sites prior to perfusion (Fig. S16A). Additional representative histology is also depicted in Fig. S16B-F.

Figure S1



Supplemental Figure S1. Behavioral economic task: Within each session, unit-price (response requirement/mg of sucrose) is manipulated by either increasing response requirement (table A, numerator of unit price) or by decreasing the quantity of sucrose delivered per response (table B, denominator of unit price). Unit-prices are identical between the two tasks. In the first task (table A): rats responded for a 45mg sucrose pellet, the response requirement increased every epoch, and a 30s time-out (lever retraction) occurred after sucrose delivery. Thus, in each epoch, a rat could obtain a maximum of 900mg sucrose. In the second task (table B): rats responded for a volume of sucrose solution (300mg/ml), the volume delivered decreased every epoch by manipulating pump durations, and a set time-out was provided in each epoch to ensure that a maximum of 450mg sucrose/epoch. The time-outs decreased as follows (30, 10, 5, 3, 1.67, 0.97, 0.54, 0.3, 0.17, 0.10s).

(C-G) Delay increases as a function of unit-price across all iterations of our behavioral economics task. All behavior corresponding to the voltammetry data from Fig. 1 are displayed. (C,D) Mean time elapsed between cue illumination and reward delivery is plotted as a function of price. All animals maintained responding across the first five price points. Filled triangles represent the order in which prices were presented. Asterisks indicate a significant increase in delay from the preceding price point. Mean time between cue presentation and reward delivery (s) are presented in tables E-G. Although data were primarily analyzed in terms of effort and magnitude costs (A,B), it is important to note that increases in delay (C-G) contribute to overall cost in these tasks, particularly when the response requirement increases. Therefore, the two tasks will be described as a cost-manipulation task (effort and delay/opportunity costs) and a reward-manipulation task (magnitude cost) to acknowledge that opportunity cost also contributes to the overall conception of cost, particularly in the cost-manipulation task.

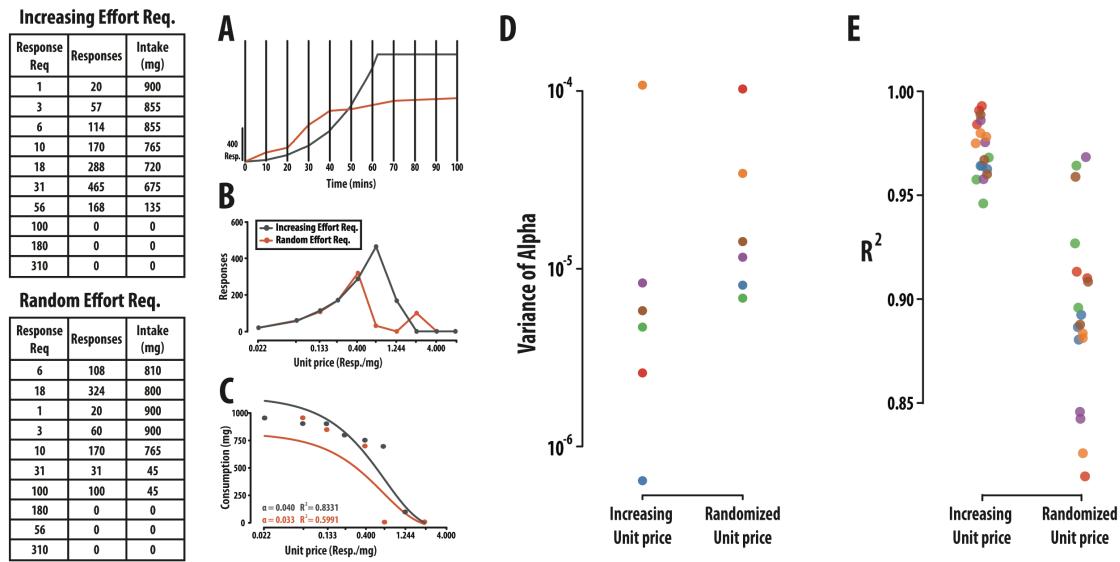
Delay (temporal discounting) discussion: It is well accepted that delays in reinforcement influence dopaminergic representations of value (1). Indeed, we (2) and others (3, 4) previously demonstrated that dopaminergic representations of value are influenced by delay using a delay-discounting task in which price is primarily manipulated by modifying delays in reinforcement availability. While dopamine is clearly inversely related to cost in the tasks used in this study, the relative contributions of effort, magnitude remain unresolved.

References:

1. Gan JO, Walton ME, & Phillips PE (2009) Dissociable cost and benefit encoding of future rewards by mesolimbic dopamine. *Nature neuroscience* 13(1):25-27.
2. Hernandez G, et al. (2014) Endocannabinoids promote cocaine-induced impulsivity and its rapid dopaminergic correlates. *Biological psychiatry* 75(6):487-498.

3. Fiorillo CD, Newsome WT, & Schultz W (2008) The temporal precision of reward prediction in dopamine neurons. *Nature neuroscience* 11(8):966-973.
4. Kobayashi S & Schultz W (2008) Influence of reward delays on responses of dopamine neurons. *Journal of neuroscience* 28(31):7837-7846.

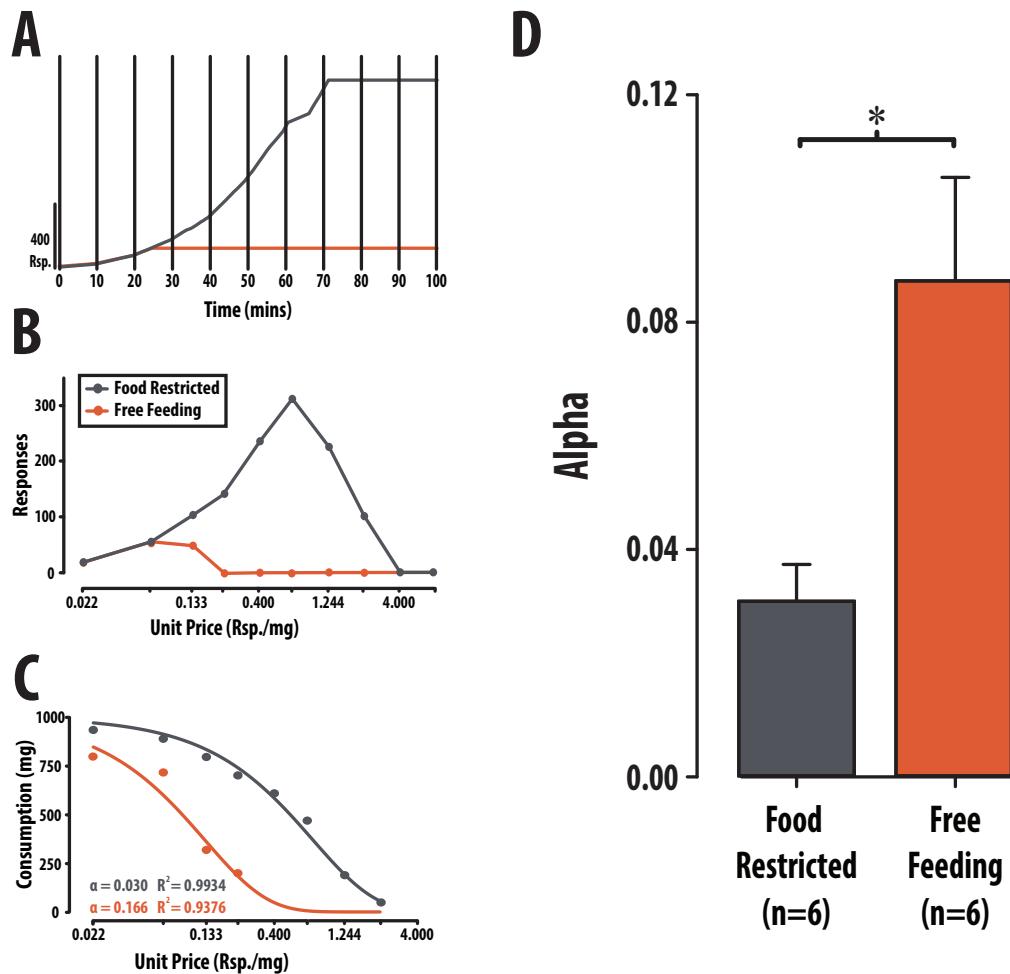
Figure S2



Supplemental Figure S2. Presenting prices in a random order produces erratic response patterns, increased within-subject variance in the sensitivity to price (alpha) and relatively poor curve fitting. A separate group of rats ($n=6$) was trained to respond for sugar pellets under an FR1 schedule of reinforcement and then entered the cost-manipulation version of the behavioral economics task. Two tasks were used, one in which response requirements increased in an ascending order (Fig S1) and another in which the ten prices were presented in a random order. In the randomized version, prices were presented so that the first five prices in the ascending progression occurred randomly, then the last five prices in the ascending progression occurred randomly. Rats responded for three consecutive days in each version of the task; assignment to the tasks was done in a counter-balanced manner. Randomly presenting unit-prices produced erratic cumulative response records (A-C), increased within-subject variance in the rate of demand curve decay (D) and resulted in less reliable curve fitting (E).

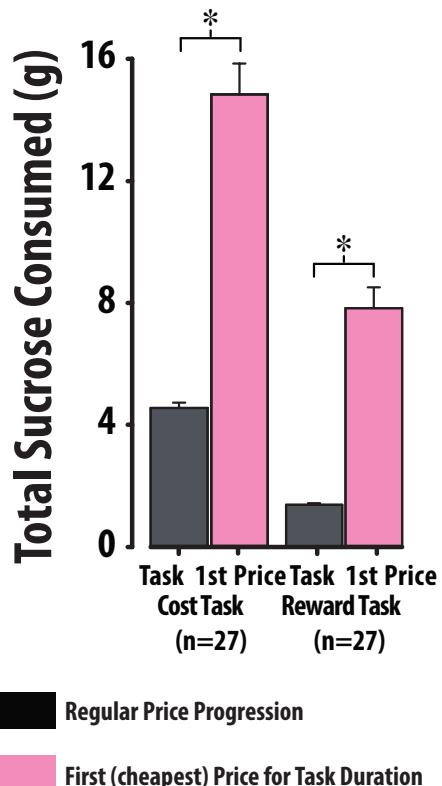
Tables on the leftmost side show response and consumption values for the representative rat illustrated in graphs A-C. Data from the response columns are graphically presented in A-B. Data converted into mg of sucrose consumption are plotted as demand curves in graph C.

Figure S3



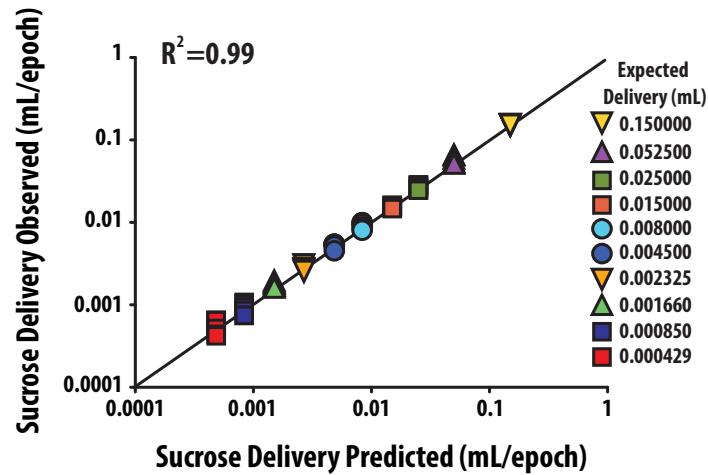
Supplemental Figure S3. Food restriction greatly decreases price sensitivity for sucrose. All animals in our study were maintained at 90% age adjusted free feeding body weight. Thus, we compared a group of food restricted rats (90%) to those allowed to free feed. After acquiring responding under a fixed-ratio 1 schedule, animals (n=6/group) responded for sugar pellets in the cost-manipulation version of the behavioral economics task. Left column shows cumulative response records (A), response-price records (B), and demand curves from two representative rats (C). Food restricted rats are represented by black; free feeding rats are represented by orange. The demand curve of the free feeding rat decays at a much faster rate. (D) Quantifying the rate of demand curve decay (α), shows that food restricted rats are less sensitive to price.

Figure S4



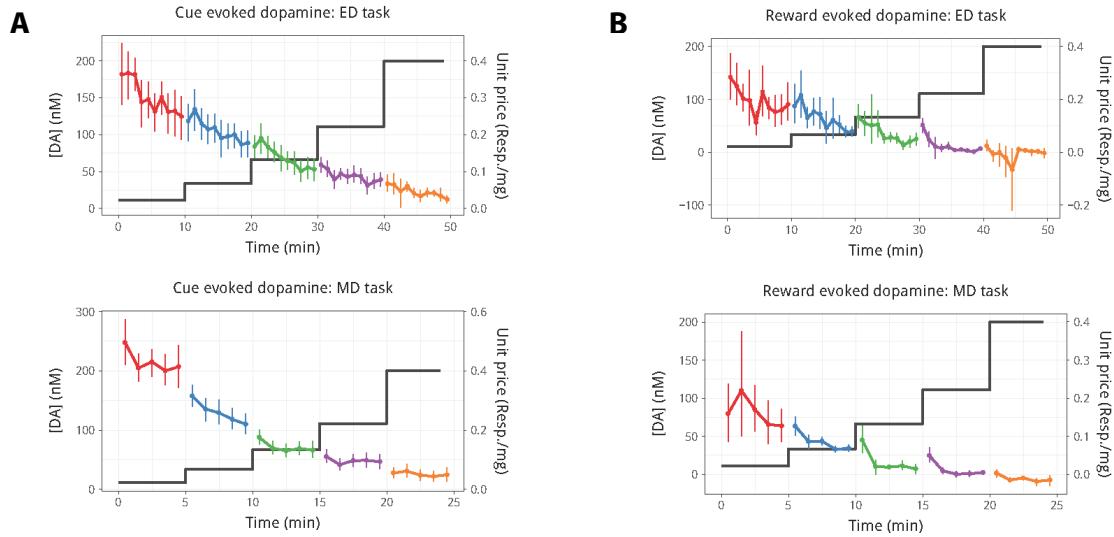
Supplemental Figure S4. Animals remain under satiety threshold in each version of the behavioral economics task. One concern is whether animals become sated in the behavioral economics task. Thus, we tested 27 rats in both versions of the behavioral economics task, and then again for the same session duration, but at the lowest unit price (0.022resp/mg). In both the cost-manipulation (left) and reward-manipulation (right) tasks, rats consumed significantly less sucrose (approximately 3x less) than when they could respond at the cheapest available price for the duration of the task. This observation led us to conclude that the animals remain under their satiety threshold as they progress through both versions of the behavioral economics task.

Figure S5



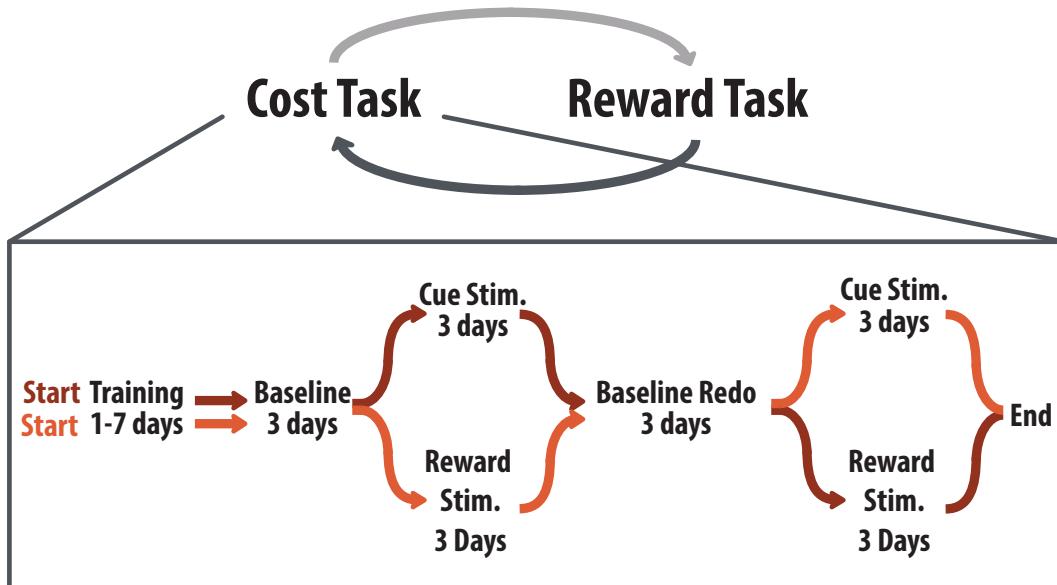
Supplemental Figure S5: Pumps lawfully deliver sucrose concentration across a range of pump durations. We previously reported that manipulating pump speeds reliably delivers predicted mls of solution across a wide range of unit prices using razel pumps (see supplemental material in Oleson and Roberts, 2009). However, as we are using different pumps (med-associates; PHM-111EC) in the present study, we further assessed whether our pumps are delivering the proper volume of sucrose solution per response. To test this, we compared predicted mls of sucrose delivered per unit-price vs. mls of sucrose observed per unit-price. This comparison resulted in a high correlation ($R^2 = 0.99$) between the two variables, suggesting our pumps are accurately delivery the appropriate volume of sucrose at each unit-price—even at short pump durations.

Figure S6



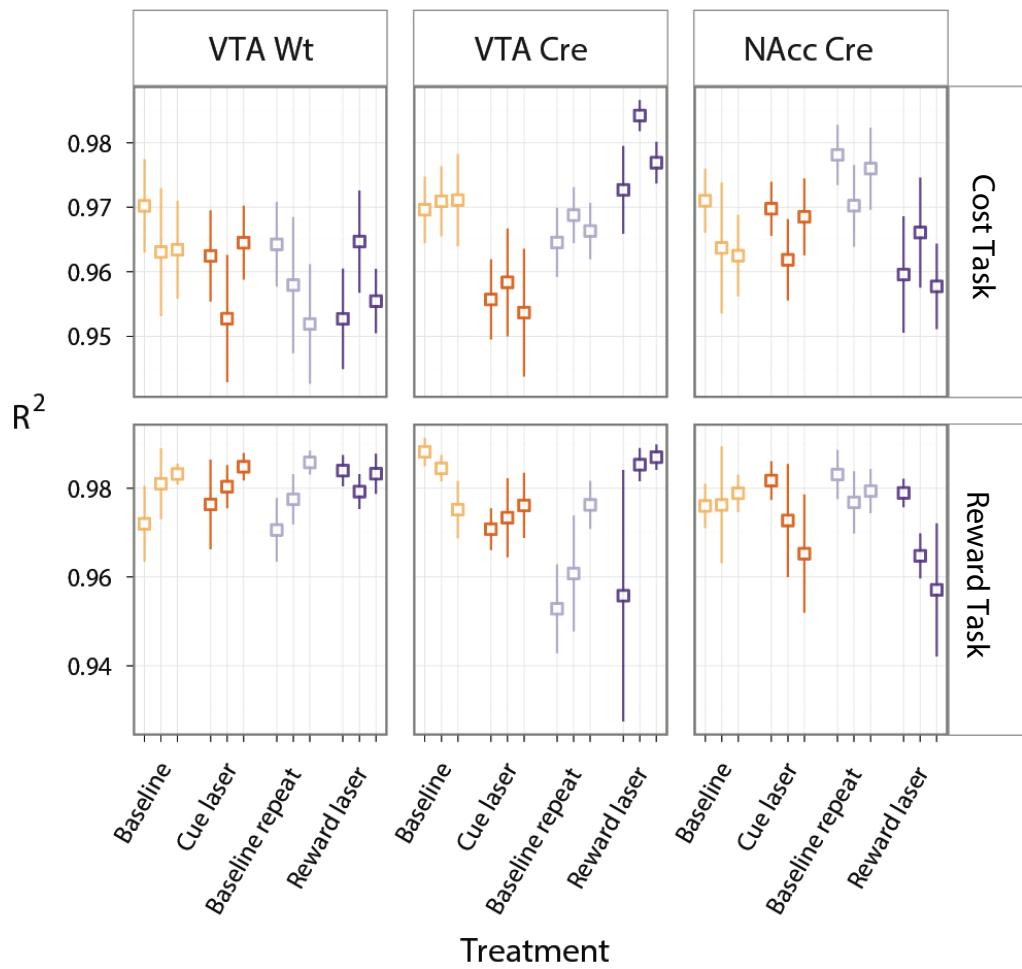
Supplemental Figure S6. Dopamine concentration at both cue (A) and reward (B) decreases within each epoch, consistent with a rapid, adaptive re-valuation process. Dopamine concentration (left y-axis) data are binned into minutes. Price (right y-axis) is denoted by the stepwise black line. Similar trends are observed in both the cost-manipulation (top) and reward-manipulation (bottom) tasks. There are twice as many data points in cost-manipulation task because each epoch lasted 10min rather than 5min.

Figure S7



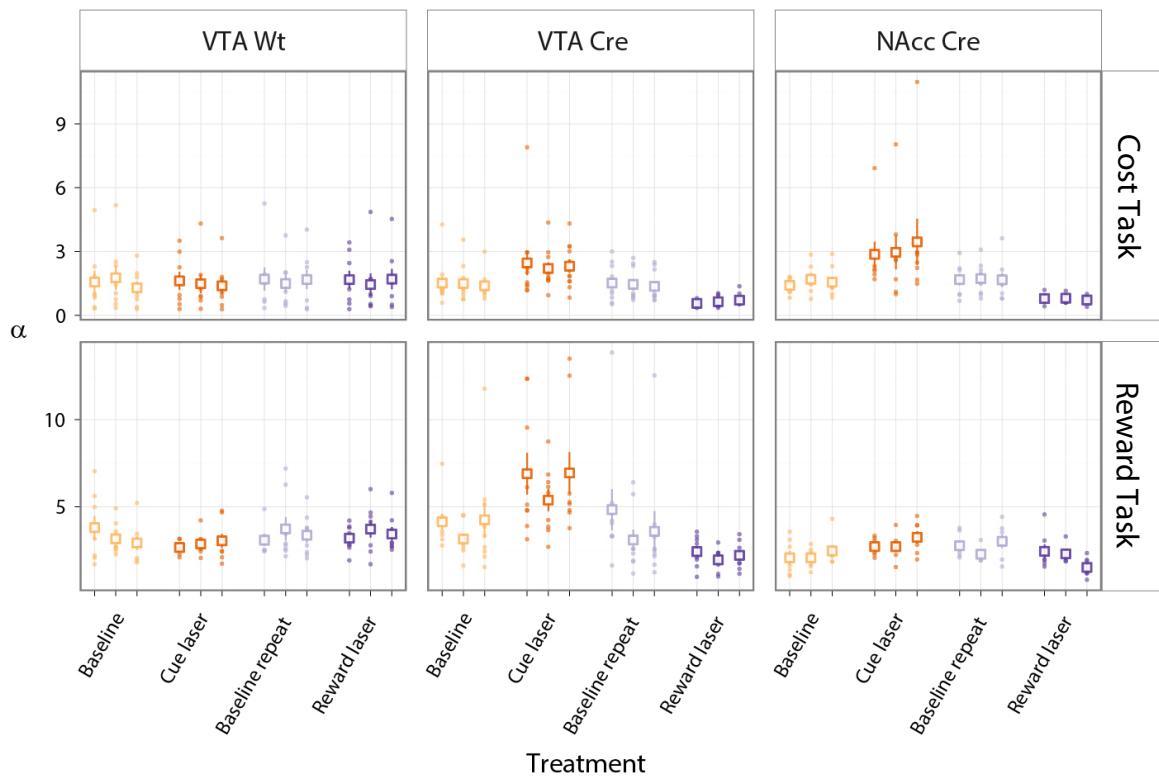
Supplemental Figure S7. Optogenetics experimental design, demonstrating counter-balanced order of stimulations. Following the establishment of a stable baseline, we recorded three baseline days (tethered with an inactive patch cable), three days in which optical stimulation occurs at either cue or sucrose delivery, three baseline days, and three days in which optical stimulation occurs at the complimentary event. Sample sizes across the cost-manipulation conditions were: WT (n=8), VTA stimulation (n=11), NAcc stimulation (n=8); sample sizes across task reward-manipulation conditions were: WT (n=8), VTA stimulation (n=9), NAcc stimulation (n=7). When possible, the same rat was used in both effort and magnitude-based tasks. Eight WT rats, nine VTA-Cre rats, and seven NAcc-Cre rats completed all replicates in each version of the task. No animals were removed due to viral transfection failure. In rare cases, rats were removed due to head-cap loss.

Figure S8



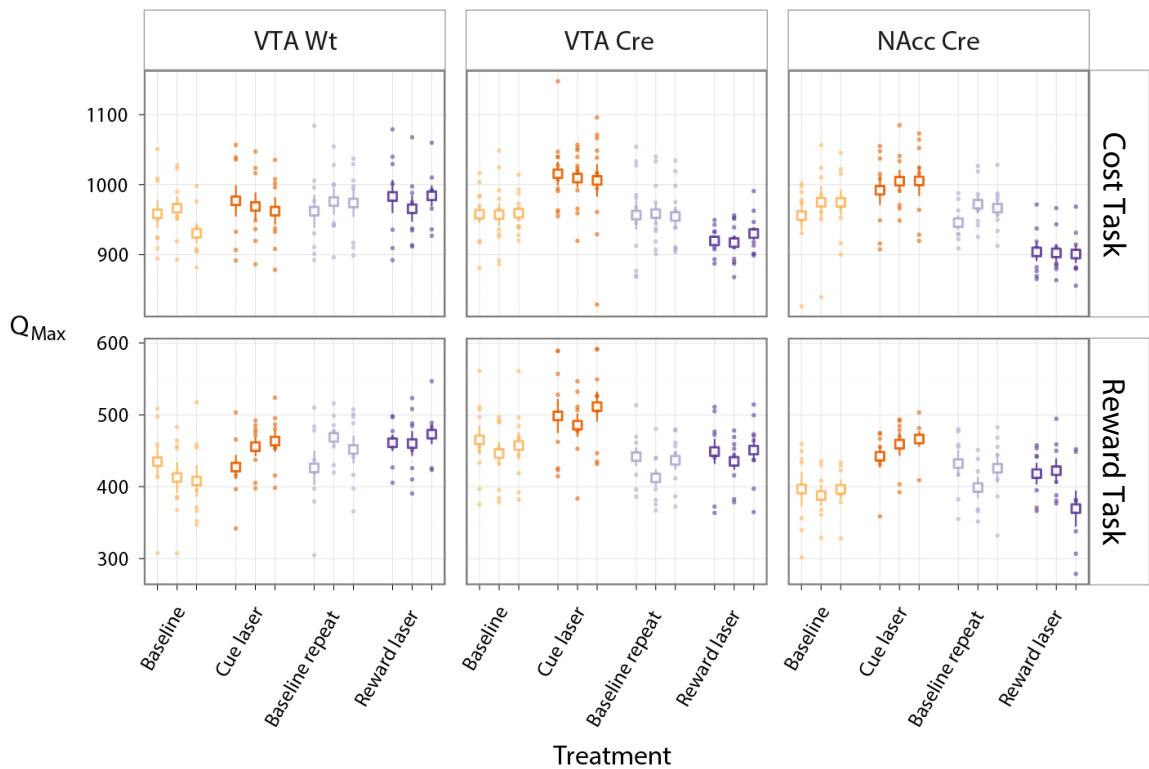
Supplemental Figure S8. We fitted demand curves to a single exponential decay model (Equation 1 in main text), which provided an excellent fit to the observed demand profiles. Mean (\pm SEM) R^2 values are shown for all fits across all conditions. For all fits, the mean R^2 value was 0.976.

Figure S9



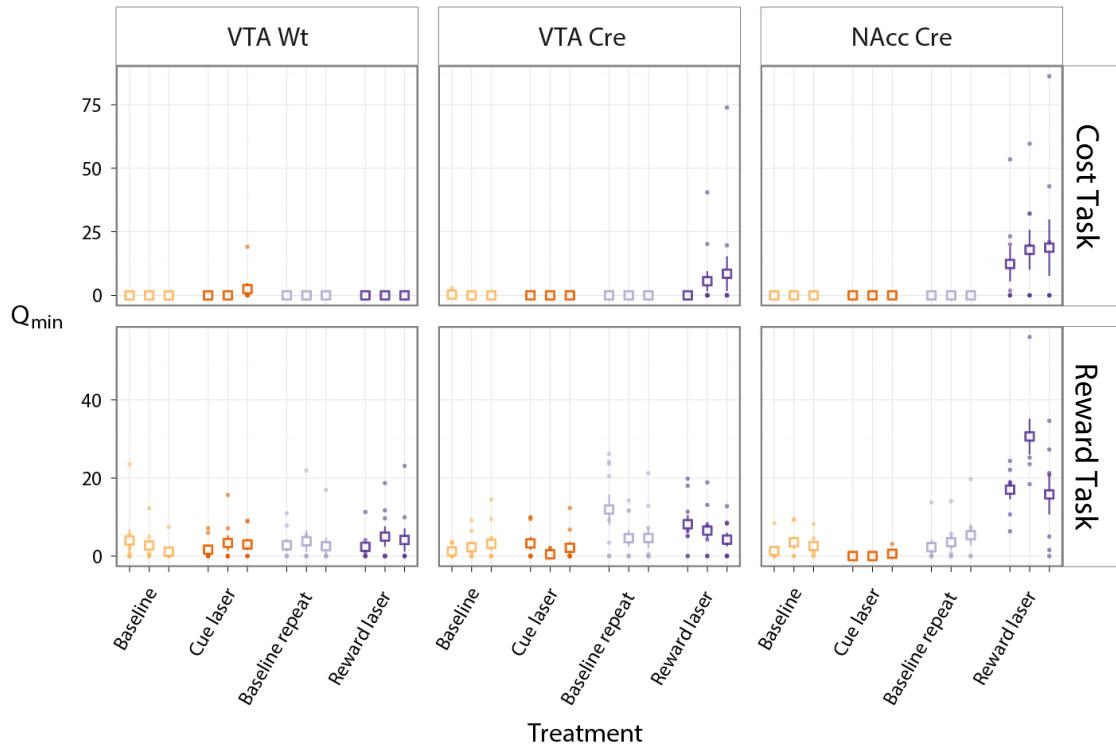
Supplemental Figure S9. All α values (mean \pm SEM) are shown across all conditions with individual data included to show variability.

Figure S10



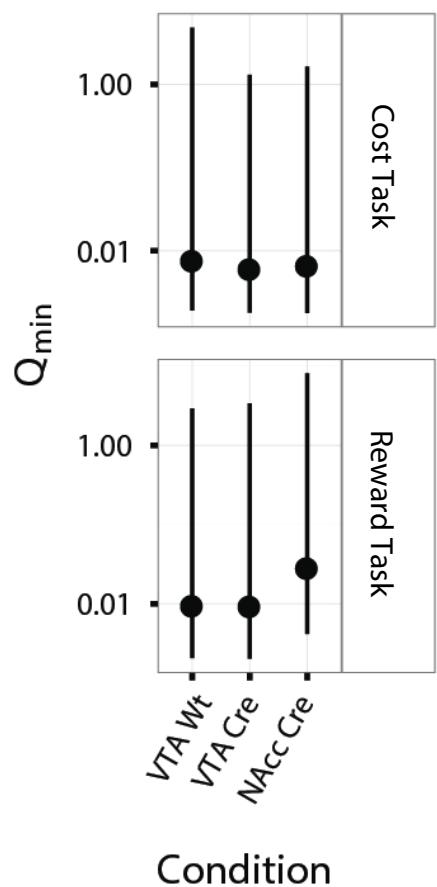
Supplemental Figure S10. All Q_{max} values (mean \pm SEM) are shown across all conditions with individual data included to show variability.

Figure S11



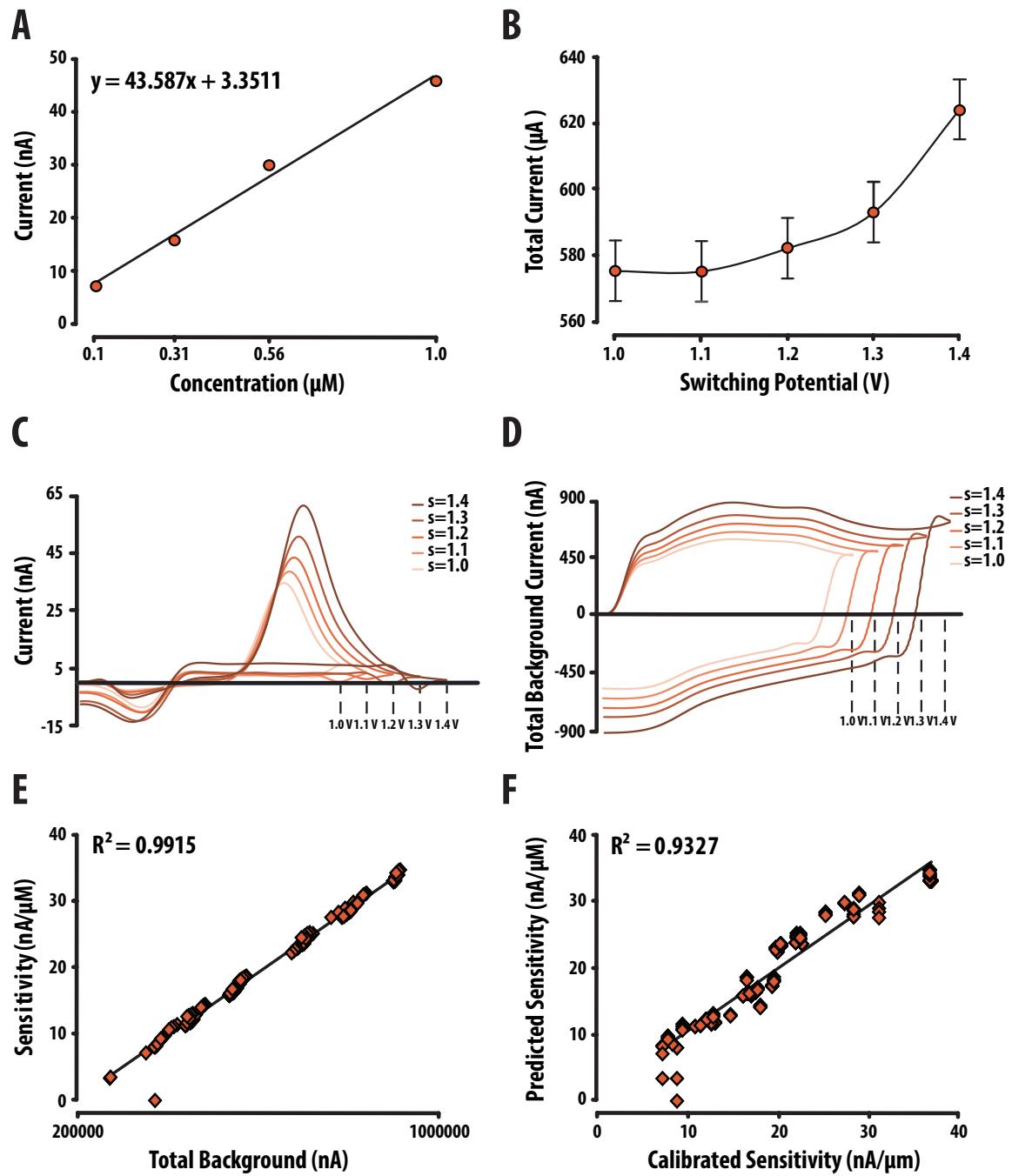
Supplemental Figure S11. All Q_{\min} values (mean \pm SEM) are shown across all conditions with individual data included to show variability.

Figure S12



Supplemental Figure S12. Bayesian analysis of Q_{\min} data reveal a negligible effect of stimulation on Q_{\min} across all conditions.

Figure S13



Supplemental Figure S13. Due to recent concerns regarding the validity of using standardized calibration factors for dopamine assessments (Rodenberg et al 2015), we applied a recently developed computational model (Roberts et al. 2013) designed to calculate calibration factors for individual electrodes used *in vivo*. By replicating Roberts et al. 2013, using 10 electrodes we obtained a set of empirical values using multiple linear regression analysis, which enables the use

of background current produced by our equipment to solve for concentration in each electrode used during *in vivo* experimentation. This calibration approach provides a fast and practical means of computing electrode-specific changes in neurochemical concentration and addresses an issue of validity regarding FSCV. We first assessed for changes in current occurring across different concentrations of dopamine and switching potentials (A-D). Current was recorded at five different switching potentials over four different dopamine concentrations. Total background current, as well as background-subtract current, was recorded to assess their correlations with increasing switching potential. Peak dopamine current was noted for each background-subtracted file and then plotted against dopamine concentration to obtain traditional calibration values for each electrode.

As expected, current lawfully increased as a function of both dopamine concentration and switching potential. Using these data, we determined the coefficients α , β , γ and δ in equation 1; C is total background current, S is the switching potential.

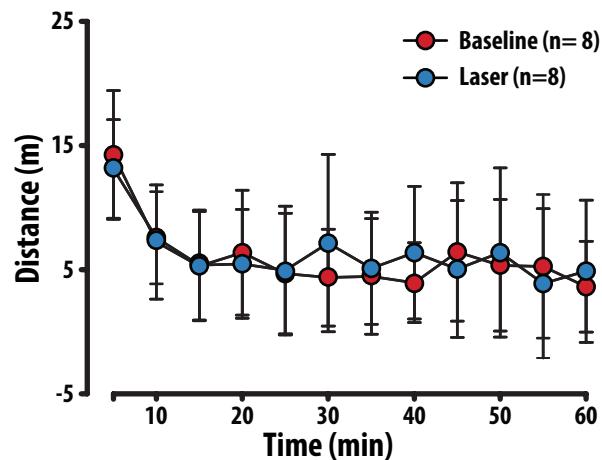
$$\text{Equation 1: sensitivity} = \alpha C + \beta S + \gamma S^2 + \delta$$

Our lab-specific coefficients are: $\alpha=4.71e^{-5}$, $\beta=17.185$, $\gamma=8.324$, $\delta=-0.656$

Using these coefficients we can calculate calibration factors for individual electrodes used *in vivo* by simply entering the observed total background current and the switching potential used for each individual recording.

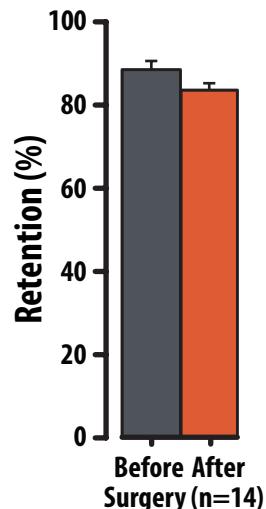
Finally, we validated this approach by comparing predicted electrode sensitivity vs. calibrated sensitivity determined *ex vivo* using a microfluidic flowcell (Sinkala E et al., 2012). We observed a high correlation between our predicted and traditionally determined calibration values. This approach was used to calculate all dopamine concentrations in the present study.

Figure S14



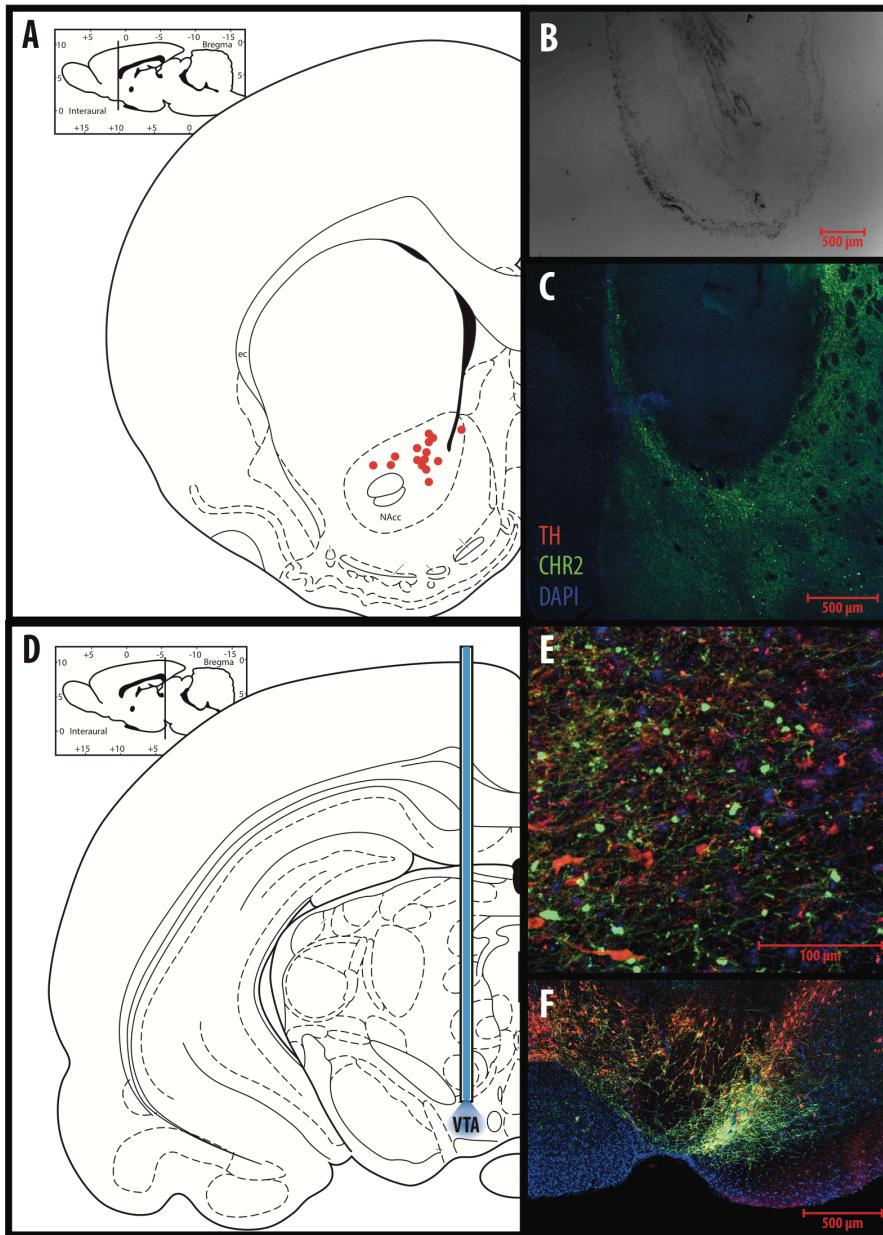
Supplemental Figure S14. To assess for general locomotor confounds produced by optical stimulation, we performed an assessment of horizontal locomotor activity. Optical stimulation occurred every 30s, which corresponds to maximal possible stimulation in the cost-manipulation version of the behavioral economics task. Three habituation days preceded data collection, and then rats received either optical stimulation (10p, 20Hz, every 30s) or no stimulation (i.e., baseline) over two consecutive days according to a within-subject counter balanced design. Animals were allowed to acclimate to activity monitor for 1hr each day, prior to data collection. Optical stimulation of failed to alter horizontal activity (n.s.).

Figure S15



Supplemental Figure S15. One concern regarding our experimental approach is whether our calculations performed using the Stanford brain tissue light transmission calculator are valid, as we implanted the optical ferrule cannulae in the brain more than four weeks prior to utilizing optical stimulation. It is possible that the output from the optical ferrule cannulae diminishes over time. To test this possibility, we successfully removed optical ferrule cannulae from 12 subjects at the culmination of the study. A t-test failed to indicate a mean difference between optical ferrule cannulae retention before and after surgery (n.s.), suggesting that the irradiance occurring at the end of experimentation is comparable to theoretical values used when calculating laser output values for each subject.

Figure S16



Supplemental Figure S16. At the end of experimentation, rats were placed under deep anesthesia using a ketamine/xylazine solution (100mg/kg; 20mg/kg, respectively) to allow for histological confirmation of microelectrode placement. Once anesthetized, we lowered a stainless steel electrode (AM systems) contained within an identical micromanipulator to the depth where working electrodes were locked during voltammetric recordings. We applied current to each stainless steel electrode using a custom DC lesion-making device (LMD1; Scott Ng-Evans) for 30s. We then transcardially perfused each subject using

saline and a 10% formalin solution before removing each lesioned brain. Brains were sectioned (50 μ m coronal slices) using a cryostat and mounted for microscopy. Lesions were initially confirmed using bright-field microscopy and then, when relevant, with either a fluorescent or confocal microscope. **Left:** Coronal diagram illustrating confirmed lesion sites within the nucleus accumbens core. **Right:** Representative histology showing lesions using brightfield (B) and fluorescent (C) microscopy in addition to viral transfection of TH expressing neurons in the ventral tegmental area (E,F).

Table S1; Stat Table For Fig. S1**A Latency vs. Unit price (resp./mg)**

Stats used for Figure Supplement 1C: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Failed, p<0.500

Brown-Forsyth: Failed, p<0.500

Source of Variation	DF	F	P
ID	23		
Epoch	4	406.730	<0.001
Epoch x ID	92		
Task	1	511.645	<0.001
Task x ID	23		
Epoch x Task	4	142.822	<0.001
Residual	92		
Total	239		

Comparison Unit price Epoch	Diff of Means	t	P
0.022	0.116	0.305	0.761
0.067	0.0593	0.156	0.876
0.133	0.752	1.982	0.50
0.222	5.149	13.563	<0.001
0.400	10.814	28.487	<0.001

Cost

Comparison Unit price Epoch	Diff of Means	t	P
0.022 vs. 0.067	1.108	2.767	0.062
0.067 vs. 0.133	1.166	2.911	0.041
0.133 vs. 0.222	5.030	12.561	<0.001
0.222 vs. 0.400	8.383	20.932	<0.001

Reward

Comparison Unit price Epoch	Diff of Means	t	P
0.022 vs. 0.067	1.165	2.908	0.041
0.067 vs. 0.133	0.472	1.180	1
0.133 vs. 0.222	0.634	1.584	1
0.222 vs. 0.400	2.718	6.786	<0.001

B Descending Latency vs. Unit price (Resp./mg)

Stats used for Figure Supplement 1D: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p= 0.421

Brown-Forsyth: Failed, p<0.500

Source of Variation	DF	F	P
Between Subjects	5		
Between Treatments	4	37.359	<0.001
Residual	20		
Total	29		

Comparison Unit price Epoch	Diff of Means	t	P
0.022 vs. 0.067	1.042	1.488	1
0.067 vs. 0.133	1.244	1.777	0.908
0.133 vs. 0.222	1.757	2.509	0.208
0.222 vs. 0.400	3.668	5.239	<0.001

Table S2; Stats Table For Fig. S4**Satiety**

**Stats used for Figure S4: One Way Anova
Bonferroni post-hoc analysis**

Source of Variation	DF	F	P
Between Groups	3	88.137	<0.001
Residual	104		
Total	107		

Comparison	Diff of Means	t	P
Num. Task vs. Num. Satiety	10.288	11.962	<0.001
Den. Task vs. Den Satiety	6.279	7.3	<0.001

Table S3; Stat Table For Fig. 1A-D**A****WT Cost task Voltammetry**Stats used for Figure 2A: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	4	158.526	<0.001
Residual	578		
Total	591		

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Cue 0.067	46.194	9.388	<0.001
Cue 0.022 vs. Cue 0.133	83.070	16.882	<0.001
Cue 0.022 vs. Cue 0.222	107.182	18.998	<0.001
Cue 0.022 vs. Cue 0.400	128.393	20.239	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Reward 0.022 vs. Reward 0.067	32.286	4.789	<0.001
Reward 0.022 vs. Reward 0.133	59.444	8.520	<0.001
Reward 0.022 vs. Reward 0.222	83.448	10.757	<0.001
Reward 0.022 vs. Reward 0.400	99.075	11.108	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Reward 0.022	54.01	9.623	<0.001
Cue 0.067 vs. Reward 0.067	43.118	7.682	<0.001
Cue 0.133 vs. Reward 0.133	52.047	9.273	<0.001
Cue 0.222 vs. Reward 0.222	53.977	9.617	<0.001
Cue 0.400 vs. Reward 0.400	87.929	15.666	<0.001

B**WT Reward task Voltammetry**Stats used for Figure 2C: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	4	29.188	<0.001
Residual	887		
Total	881		

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Cue 0.067	85.241	12.580	<0.001
Cue 0.022 vs. Cue 0.133	144.360	22.755	<0.001
Cue 0.022 vs. Cue 0.222	167.654	26.706	<0.001
Cue 0.022 vs. Cue 0.400	190.177	28.575	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Reward 0.022 vs. Reward 0.067	33.382	7.436	<0.001
Reward 0.022 vs. Reward 0.133	59.724	14.232	<0.001
Reward 0.022 vs. Reward 0.222	69.894	16.868	<0.001
Reward 0.022 vs. Reward 0.400	80.765	18.777	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Reward 0.022	102.307	31.713	<0.001
Cue 0.067 vs. Reward 0.067	37.499	11.624	<0.001
Cue 0.133 vs. Reward 0.133	27.771	8.608	<0.001
Cue 0.222 vs. Reward 0.222	15.238	4.724	<0.001
Cue 0.400 vs. Reward 0.400	30.022	9.306	<0.001

Table S4; Stat Table For Fig. 1E**Reverse Cost Voltammetry**

Stats used for Figure 1E: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	4	16.971	<0.001
Residual	538		
Total	542		

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Cue 0.067	128.729	2.783	0.080
Cue 0.022 vs. Cue 0.133	109.841	6.179	<0.001
Cue 0.022 vs. Cue 0.222	69.430	9.775	<0.001
Cue 0.022 vs. Cue 0.400	31.275	11.116	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Reward 0.022 vs. Reward 0.067	33.496	2.783	0.047
Reward 0.022 vs. Reward 0.133	54.131	6.179	<0.001
Reward 0.022 vs. Reward 0.222	66.421	9.775	<0.001
Reward 0.022 vs. Reward 0.400	76.142	11.456	<0.001

Comparison (Cond., Unit-price)	Diff of Means	t	P
Cue 0.022 vs. Reward 0.022	83.655	2.821	<0.001
Cue 0.067 vs. Reward 0.067	85.876	3.653	<0.001
Cue 0.133 vs. Reward 0.133	68.356	6.206	<0.001
Cue 0.222 vs. Reward 0.222	40.235	7.797	0.001
Cue 0.400 vs. Reward 0.400	31.067	7.596	0.010

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
Bilateral Cre	Reward	Baseline	236	1	3.5700604678	459.4782270002	0.0749963165	0.9911392315
Bilateral Cre	Reward	Baseline	236	2	2.3612042118	429.9424418153	3.0205021131	0.9914744513
Bilateral Cre	Reward	Baseline	236	3	2.5997234124	429.4430800778	3.2470413115	0.9605135795
Bilateral Cre	Reward	Baseline	254	1	2.707534225	449.4148514168	0.7319000579	0.9916054696
Bilateral Cre	Reward	Baseline	254	2	2.8696409315	408.3344497213	3.0075664868	0.9919892561
Bilateral Cre	Reward	Baseline	254	3	2.2644808679	422.7409059137	8.209861073	0.9838171761
Bilateral Cre	Reward	Baseline	255	1	1.1200304927	356.1233094131	0	0.9686413531
Bilateral Cre	Reward	Baseline	255	2	2.2906341503	368.03112192	0	0.9906273522
Bilateral Cre	Reward	Baseline	255	3	4.3076193912	378.4215818799	4.5391469432	0.9680253413
Bilateral Cre	Reward	Baseline	394	1	3.1150204194	433.3047521303	8.4383666831	0.968720072
Bilateral Cre	Reward	Baseline	394	2	1.5890643716	360.7143143856	9.2493915763	0.9930694054
Bilateral Cre	Reward	Baseline	394	3	2.1796286204	392.2473023195	0	0.976939475
Bilateral Cre	Reward	Baseline	901	1	1.379587156	301.5224362817	0	0.9650258965
Bilateral Cre	Reward	Baseline	901	2	2.5338375353	328.9283277499	9.4295271486	0.9787836243
Bilateral Cre	Reward	Baseline	901	3	1.8529957569	327.8977679917	0.7691363544	0.9886508768
Bilateral Cre	Reward	Baseline	920	1	1.0341220094	339.7758651643	0	0.9604454515
Bilateral Cre	Reward	Baseline	920	2	1.24891266	383.2295736331	0	0.8983510571
Bilateral Cre	Reward	Baseline	920	3	2.2279635691	433.5924374929	1.3093139792	0.9824834641
Bilateral Cre	Reward	Baseline	923	1	1.6306199621	438.1083599866	0	0.986408846
Bilateral Cre	Reward	Baseline	923	2	1.6869452333	435.1091675203	0	0.9892306992
Bilateral Cre	Reward	Baseline	923	3	1.8624457714	389.3760139599	0	0.9913907234
Bilateral Cre	Reward	Baseline repeat	236	1	2.3764097451	477.1305684255	0.0481709279	0.9974988703
Bilateral Cre	Reward	Baseline repeat	236	2	1.9175272802	438.9797966125	0	0.9862403316
Bilateral Cre	Reward	Baseline repeat	236	3	2.8292482899	444.2319392851	0	0.9878703583
Bilateral Cre	Reward	Baseline repeat	254	1	3.7825592771	480.0892360663	13.7205676034	0.9882366968
Bilateral Cre	Reward	Baseline repeat	254	2	2.206235022	451.4141982277	5.7576803437	0.9943667252
Bilateral Cre	Reward	Baseline repeat	254	3	3.0432223178	482.6059267581	7.272190741	0.9923781888
Bilateral Cre	Reward	Baseline repeat	255	1	2.2043061502	354.9128387213	2.1116404635	0.9837668943
Bilateral Cre	Reward	Baseline repeat	255	2	2.2410168995	365.8893261214	0	0.9731078399
Bilateral Cre	Reward	Baseline repeat	255	3	3.7656391034	468.4095479491	5.0298924589	0.9800038499
Bilateral Cre	Reward	Baseline repeat	394	1	3.652800772	455.8243097024	0	0.9711615368
Bilateral Cre	Reward	Baseline repeat	394	2	2.294971994	421.4231955809	4.4391502931	0.9787366427
Bilateral Cre	Reward	Baseline repeat	394	3	1.5771751231	332.101279808	0	0.9597588089
Bilateral Cre	Reward	Baseline repeat	901	1	2.0940983786	382.4200740593	0	0.9910493867
Bilateral Cre	Reward	Baseline repeat	901	2	1.938133827	368.579427015	14.0568828585	0.9376440182
Bilateral Cre	Reward	Baseline repeat	901	3	3.5429736987	455.528198268	19.7260605338	0.9622250062
Bilateral Cre	Reward	Baseline repeat	920	1	2.6962739914	416.9410696941	0	0.9561702226
Bilateral Cre	Reward	Baseline repeat	920	2	3.0968726861	351.5313211705	0	0.9829392532
Bilateral Cre	Reward	Baseline repeat	920	3	4.4207193677	386.5817996437	5.4145904754	0.9839946102
Bilateral Cre	Reward	Baseline repeat	923	1	2.5381998072	458.81121458	0	0.9935992614
Bilateral Cre	Reward	Baseline repeat	923	2	2.2647936635	394.9877700496	0.7582297711	0.9845445892
Bilateral Cre	Reward	Baseline repeat	923	3	1.9776558089	410.1159887634	0	0.9889836746
Bilateral Cre	Reward	Cue laser	236	1	2.698089489	358.8338650451	0	0.9879843818
Bilateral Cre	Reward	Cue laser	236	2	3.0490935576	484.7052284997	0	0.988459328
Bilateral Cre	Reward	Cue laser	236	3	2.8208511609	470.0844734992	0	0.97563559
Bilateral Cre	Reward	Cue laser	254	1	3.0453644894	431.0797917941	0	0.9891804351
Bilateral Cre	Reward	Cue laser	254	2	2.2410375706	470.0915124298	0	0.9934974528
Bilateral Cre	Reward	Cue laser	254	3	3.9428530538	503.447889461	1.0893409358	0.9901569852
Bilateral Cre	Reward	Cue laser	255	1	2.2707720274	473.6841032803	0	0.983943854
Bilateral Cre	Reward	Cue laser	255	2	1.5441651789	392.339571717	0	0.9004461093
Bilateral Cre	Reward	Cue laser	255	3	3.2235037379	409.1864736081	3.0964460332	0.9784894359
Bilateral Cre	Reward	Cue laser	394	1	3.3386382914	474.743947001	0	0.9931234189
Bilateral Cre	Reward	Cue laser	394	2	3.9553948914	403.4976710837	0	0.976719492
Bilateral Cre	Reward	Cue laser	394	3	4.470583861	463.6800137451	0	0.9901575817
Bilateral Cre	Reward	Cue laser	901	1	2.383702176	436.3670700636	0	0.9646789019
Bilateral Cre	Reward	Cue laser	901	2	2.8758687704	493.5020872878	0	0.9954448093
Bilateral Cre	Reward	Cue laser	901	3	3.9392030421	481.4186756181	0	0.9563126139
Bilateral Cre	Reward	Cue laser	920	1	2.0749627055	466.8598364491	0	0.9659830843
Bilateral Cre	Reward	Cue laser	920	2	2.7266448389	491.779359467	0	0.9652225493

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
Bilateral Cre	Reward	Cue laser	920	3	1.9848667883	467.6555721371		0 0.9762359124
Bilateral Cre	Reward	Cue laser	923	1	3.2150155186	455.3144157762		0 0.9869645904
Bilateral Cre	Reward	Cue laser	923	2	2.582226328	478.8190285155		0 0.9891023478
Bilateral Cre	Reward	Cue laser	923	3	2.3470770712	469.8704258729		0 0.8897379192
Bilateral Cre	Reward	Reward laser	236	1	1.993035075	441.7881618121	10.6848345467	0.9913193654
Bilateral Cre	Reward	Reward laser	236	2	3.3016625706	494.6855336859	56.1138117119	0.9644307327
Bilateral Cre	Reward	Reward laser	236	3	1.2802181477	337.8862632026	20.8152784281	0.8878808731
Bilateral Cre	Reward	Reward laser	254	1	4.5594497204	366.3389748074	6.3412740762	0.975638978
Bilateral Cre	Reward	Reward laser	254	2	2.2714131302	450.0451820888	30.6958881327	0.9655140849
Bilateral Cre	Reward	Reward laser	254	3	1.9555272821	448.6650305236	21.2538973998	0.9844805645
Bilateral Cre	Reward	Reward laser	255	1	1.9270290941	453.6322429311	18.8517109537	0.9817701598
Bilateral Cre	Reward	Reward laser	255	2	2.063939732	458.8084691709	23.5371023132	0.9802840811
Bilateral Cre	Reward	Reward laser	255	3	1.9038945906	452.219009239	34.6461367054	0.9787570335
Bilateral Cre	Reward	Reward laser	394	1	3.0661107539	457.6729701994	22.0989072846	0.9810355712
Bilateral Cre	Reward	Reward laser	394	2	2.2386017504	406.5581483643	30.0587372887	0.9746024317
Bilateral Cre	Reward	Reward laser	394	3	2.3483548874	382.0500972023	27.3133441132	0.9741049402
Bilateral Cre	Reward	Reward laser	901	1	1.7470233152	370.8107582969	17.9421338032	0.9742769231
Bilateral Cre	Reward	Reward laser	901	2	1.915363597	388.0163488256	30.2395136196	0.9403586964
Bilateral Cre	Reward	Reward laser	901	3	1.1810247697	306.8666868542		0 0.9708825109
Bilateral Cre	Reward	Reward laser	920	1	1.5701549891	442.6834035115	18.8105329884	0.9837421073
Bilateral Cre	Reward	Reward laser	920	2	2.4487771014	380.7294657573	25.237128732	0.9719991673
Bilateral Cre	Reward	Reward laser	920	3	0.8131729461	278.685677688	1.5682145902	0.9136848642
Bilateral Cre	Reward	Reward laser	923	1	2.2715433191	394.9877257797	24.3831570697	0.9645787963
Bilateral Cre	Reward	Reward laser	923	2	1.8711152427	376.6760056859	18.4032999449	0.956034581
Bilateral Cre	Reward	Reward laser	923	3	1.2005966702	380.1483490691	5.005692524	0.9898234133
Bilateral Cre	Cost	Baseline	236	1	1.7153960471	1001.3777153831		0 0.9660750499
Bilateral Cre	Cost	Baseline	236	2	2.2844213311	1010.4944229366		0 0.98621337
Bilateral Cre	Cost	Baseline	236	3	1.3370600931	967.5422209385		0 0.9553075387
Bilateral Cre	Cost	Baseline	239	1	1.811410212	978.0708510172		0 0.9545644521
Bilateral Cre	Cost	Baseline	239	2	2.8559841521	1056.2694139638		0 0.9468488624
Bilateral Cre	Cost	Baseline	239	3	2.8779460164	1045.3787877898		0 0.9471686471
Bilateral Cre	Cost	Baseline	254	1	1.4324731422	949.1957447		0 0.9918310297
Bilateral Cre	Cost	Baseline	254	2	1.45044475	971.5313716835		0 0.9703673062
Bilateral Cre	Cost	Baseline	254	3	0.994268057	916.6021595797		0 0.9629391579
Bilateral Cre	Cost	Baseline	255	1	1.7759246343	989.2160868721		0 0.9632004688
Bilateral Cre	Cost	Baseline	255	2	1.6714024194	986.1439017663		0 0.9746306104
Bilateral Cre	Cost	Baseline	255	3	2.3103882089	1021.8814690686		0 0.9662282889
Bilateral Cre	Cost	Baseline	394	1	1.113659583	826.6590110898		0 0.9853510883
Bilateral Cre	Cost	Baseline	394	2	1.4808904167	839.3821511305		0 0.9871391049
Bilateral Cre	Cost	Baseline	394	3	1.3115862861	900.5637206866		0 0.9934919653
Bilateral Cre	Cost	Baseline	901	1	0.8287079656	974.0281351736		0 0.9655566283
Bilateral Cre	Cost	Baseline	901	2	0.7674193645	950.5809094464		0 0.9630692767
Bilateral Cre	Cost	Baseline	901	3	0.834110679	952.9168683314		0 0.9723326546
Bilateral Cre	Cost	Baseline	920	1	1.5168666465	997.6793609536		0 0.9574553285
Bilateral Cre	Cost	Baseline	920	2	1.894493134	1023.7475382147		0 0.9008042331
Bilateral Cre	Cost	Baseline	920	3	1.4968124505	1015.8595041617		0 0.9337395248
Bilateral Cre	Cost	Baseline	923	1	1.0780660961	930.6617428934		0 0.9841441784
Bilateral Cre	Cost	Baseline	923	2	1.1336010542	961.0980511521		0 0.9803983825
Bilateral Cre	Cost	Baseline	923	3	1.278884235	976.6959572252		0 0.9688791222
Bilateral Cre	Cost	Baseline repeat	236	1	2.1179499291	987.638401918		0 0.9875509757
Bilateral Cre	Cost	Baseline repeat	236	2	2.3275061609	1026.7689991451		0 0.9733336522
Bilateral Cre	Cost	Baseline repeat	236	3	1.8351931131	987.2706502292		0 0.9862048939
Bilateral Cre	Cost	Baseline repeat	239	1	2.2097656685	929.2152795269		0 0.9599552221
Bilateral Cre	Cost	Baseline repeat	239	2	3.087454873	986.4296090175		0 0.9685678496
Bilateral Cre	Cost	Baseline repeat	239	3	3.6222739881	1028.1218211949		0 0.9683374739
Bilateral Cre	Cost	Baseline repeat	254	1	0.9606334347	909.0195329768		0 0.958781056
Bilateral Cre	Cost	Baseline repeat	254	2	1.0506490051	941.836638578		0 0.9793827496
Bilateral Cre	Cost	Baseline repeat	254	3	1.0286669806	949.7138471759		0 0.983291385
Bilateral Cre	Cost	Baseline repeat	255	1	1.7980814987	945.7341932539		0 0.9747774407

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
Bilateral Cre	Cost	Baseline repeat	255	2	2.1258820946	1019.0515519593		0 0.9670789243
Bilateral Cre	Cost	Baseline repeat	255	3	1.6355535843	983.9312440854		0 0.9688911343
Bilateral Cre	Cost	Baseline repeat	394	1	1.7089904006	962.9742514901		0 0.9913259557
Bilateral Cre	Cost	Baseline repeat	394	2	1.4775805751	965.0814934223		0 0.9831392597
Bilateral Cre	Cost	Baseline repeat	394	3	2.1473274038	979.4259616022		0 0.9832083973
Bilateral Cre	Cost	Baseline repeat	901	1	0.6813795929	922.2115016118		0 0.9798118335
Bilateral Cre	Cost	Baseline repeat	901	2	0.7911579621	948.1680051082		0 0.9693422833
Bilateral Cre	Cost	Baseline repeat	901	3	0.7916710106	933.9289609145		0 0.9895390088
Bilateral Cre	Cost	Baseline repeat	920	1	0.9958257199	929.3190949594		0 0.9795710341
Bilateral Cre	Cost	Baseline repeat	920	2	0.9787517328	963.3705664005		0 0.9307712948
Bilateral Cre	Cost	Baseline repeat	920	3	0.7902930555	956.8851894832		0 0.9370502663
Bilateral Cre	Cost	Baseline repeat	923	1	2.931961987	979.8180456556		0 0.9932306042
Bilateral Cre	Cost	Baseline repeat	923	2	1.9532142604	925.4367649977		0 0.9902540354
Bilateral Cre	Cost	Baseline repeat	923	3	1.4529193919	912.6533453014		0 0.991367648
Bilateral Cre	Cost	Cue laser	236	1	2.1725503417	1008.2633131112		0 0.9828388076
Bilateral Cre	Cost	Cue laser	236	2	1.1034372456	948.7608984716		0 0.9473533794
Bilateral Cre	Cost	Cue laser	236	3	2.4839650091	964.1417207211		0 0.9707162489
Bilateral Cre	Cost	Cue laser	239	1	6.9181121237	915.9513981456		0 0.9508173224
Bilateral Cre	Cost	Cue laser	239	2	8.0364827363	965.9955479536		0 0.971265498
Bilateral Cre	Cost	Cue laser	239	3	10.9749501806	928.5534715712		0 0.9833086038
Bilateral Cre	Cost	Cue laser	254	1	2.9348896958	1047.7606999914		0 0.9741551526
Bilateral Cre	Cost	Cue laser	254	2	1.6950993459	1001.9561798886		0 0.9430572017
Bilateral Cre	Cost	Cue laser	254	3	2.9570599059	1024.1256183491		0 0.9893740194
Bilateral Cre	Cost	Cue laser	255	1	2.8591964632	1055.1020707979		0 0.9637771675
Bilateral Cre	Cost	Cue laser	255	2	2.6324361471	1033.5965885426		0 0.9541716671
Bilateral Cre	Cost	Cue laser	255	3	2.9560631657	1073.0934695304		0 0.9396367653
Bilateral Cre	Cost	Cue laser	394	1	2.0966341766	907.677535402		0 0.984784744
Bilateral Cre	Cost	Cue laser	394	2	2.5848873912	970.7727878967		0 0.9911703887
Bilateral Cre	Cost	Cue laser	394	3	1.4826941885	919.710696385		0 0.9768593242
Bilateral Cre	Cost	Cue laser	901	1	1.9206992073	1015.4591261307		0 0.9746026283
Bilateral Cre	Cost	Cue laser	901	2	2.8143771283	1040.8287892724		0 0.9726726762
Bilateral Cre	Cost	Cue laser	901	3	2.2270068861	1064.149933678		0 0.957558592
Bilateral Cre	Cost	Cue laser	920	1	2.3105840313	1037.1535609636		0 0.9692907329
Bilateral Cre	Cost	Cue laser	920	2	0.9949510316	991.1796569846		0 0.9419011172
Bilateral Cre	Cost	Cue laser	920	3	2.8497250287	1052.2784106279		0 0.9771380231
Bilateral Cre	Cost	Cue laser	923	1	1.6976167272	949.0749568455		0 0.9579006288
Bilateral Cre	Cost	Cue laser	923	2	3.798003744	1084.8753619112		0 0.9733682699
Bilateral Cre	Cost	Cue laser	923	3	1.668530787	1016.2225676077		0 0.9535302752
Bilateral Cre	Cost	Reward laser	236	1	0.6559144046	869.4515330358	1.852065828	0.9437729968
Bilateral Cre	Cost	Reward laser	236	2	0.9047322594	863.6635715701	32.0868637259	0.9412267525
Bilateral Cre	Cost	Reward laser	236	3	0.8479261675	880.9840283651	21.07459216	0.9572713494
Bilateral Cre	Cost	Reward laser	239	1	1.1891893796	876.8782166581	23.2110800903	0.9806411421
Bilateral Cre	Cost	Reward laser	239	2	1.1480385185	879.6526625122	19.505166239	0.9881292831
Bilateral Cre	Cost	Reward laser	239	3	0.6567982691	855.7901995353		0 0.9751713068
Bilateral Cre	Cost	Reward laser	254	1	0.815155943	937.409068523		0 0.9829265779
Bilateral Cre	Cost	Reward laser	254	2	0.7129688698	966.6603092851		0 0.9695795196
Bilateral Cre	Cost	Reward laser	254	3	0.8140166571	968.557055903		0 0.946182404
Bilateral Cre	Cost	Reward laser	255	1	0.7241533108	865.4735432005	20.0215231885	0.9084445024
Bilateral Cre	Cost	Reward laser	255	2	0.9268640415	886.8308195376	32.22674587	0.9515308037
Bilateral Cre	Cost	Reward laser	255	3	0.9972984977	879.7803558396	42.8813935816	0.9398092814
Bilateral Cre	Cost	Reward laser	394	1	0.9034141833	918.7906371491		0 0.9764805446
Bilateral Cre	Cost	Reward laser	394	2	0.6189439215	886.7674321326		0 0.9862798892
Bilateral Cre	Cost	Reward laser	394	3	0.6294791707	881.853294422		0 0.9853768654
Bilateral Cre	Cost	Reward laser	901	1	0.4216450595	882.065471341		0 0.968070073
Bilateral Cre	Cost	Reward laser	901	2	0.5924252662	910.8521991203		0 0.9838081716
Bilateral Cre	Cost	Reward laser	901	3	0.6365872904	931.291920523		0 0.9727803979
Bilateral Cre	Cost	Reward laser	920	1	0.6805076865	971.6794618763		0 0.945015846
Bilateral Cre	Cost	Reward laser	920	2	0.5845847478	943.3465807578		0 0.9247832167
Bilateral Cre	Cost	Reward laser	920	3	0.3982567725	914.4285310048		0 0.9313576394

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
Bilateral Cre	Cost	Reward laser	923	1	0.8988465517	910.6170908038	53.4667183796	0.9712430172
Bilateral Cre	Cost	Reward laser	923	2	0.909634735	883.1474451386	59.6611530042	0.9832424787
Bilateral Cre	Cost	Reward laser	923	3	0.7764970604	895.5544863604	86.1996913059	0.9539423545
VTA Cre	Reward	Baseline	63	1	4.1796839454	511.0137470557	0	0.9927347547
VTA Cre	Reward	Baseline	63	2	3.3095151686	490.4266441447	1.3288770486	0.998076418
VTA Cre	Reward	Baseline	63	3	2.4378695805	382.3051995968	0	0.9369469339
VTA Cre	Reward	Baseline	65	1	4.151616892	507.3685391343	0	0.979306721
VTA Cre	Reward	Baseline	65	2	4.4914015703	497.2929728865	2.7200723681	0.9819545932
VTA Cre	Reward	Baseline	65	3	3.3411848307	496.2738426749	0	0.9914985161
VTA Cre	Reward	Baseline	67	1	3.5912575325	455.6972403313	0	0.9911203198
VTA Cre	Reward	Baseline	67	2	3.2800440016	432.2333167877	6.4554356875	0.9804412467
VTA Cre	Reward	Baseline	67	3	3.869632287	484.2483337262	4.5707932061	0.9946310599
VTA Cre	Reward	Baseline	68	1	2.7856679361	433.4276702056	3.6288395278	0.9970093753
VTA Cre	Reward	Baseline	68	2	3.0484821309	489.7801965848	9.1626250014	0.9866384212
VTA Cre	Reward	Baseline	68	3	5.4155373205	443.7508131549	14.4624366841	0.9731684082
VTA Cre	Reward	Baseline	71	1	3.1311679732	375.512147204	0.2632387882	0.9680615227
VTA Cre	Reward	Baseline	71	2	2.5061926663	378.5544346109	0	0.9835024771
VTA Cre	Reward	Baseline	71	3	2.6892726878	418.680524738	0	0.9663002394
VTA Cre	Reward	Baseline	176	1	3.3919657504	448.8092069499	0.2313471136	0.994735254
VTA Cre	Reward	Baseline	176	2	2.6913173054	384.1814507546	0	0.9795261388
VTA Cre	Reward	Baseline	176	3	11.7617739241	560.8072071595	9.4305875288	0.9848521955
VTA Cre	Reward	Baseline	178	1	7.4648579208	561.239333846	3.4808232943	0.9828426254
VTA Cre	Reward	Baseline	178	2	1.6239087921	395.2826457647	0	0.9672654362
VTA Cre	Reward	Baseline	178	3	1.549470347	392.1949998235	0	0.9554747017
VTA Cre	Reward	Baseline	729	1	4.1208678092	496.7315253952	3.3302095581	0.9941464168
VTA Cre	Reward	Baseline	729	2	2.8715424986	493.0329155908	0	0.992005815
VTA Cre	Reward	Baseline	729	3	2.1443391983	467.1495152672	0	0.9907619419
VTA Cre	Reward	Baseline	732	1	4.4401928917	396.7692323641	0	0.9934732014
VTA Cre	Reward	Baseline	732	2	4.5358118813	454.9255854606	0.9486887721	0.990787008
VTA Cre	Reward	Baseline	732	3	5.1159405365	469.9550221287	0	0.9826869566
VTA Cre	Reward	Baseline repeat	63	1	5.2151933676	445.5162717757	23.5952851115	0.9284724236
VTA Cre	Reward	Baseline repeat	63	2	1.912587125	367.0060009284	0	0.9699116884
VTA Cre	Reward	Baseline repeat	63	3	2.3087936334	411.8359986556	0	0.9756190564
VTA Cre	Reward	Baseline repeat	65	1	3.3466428716	416.6737214777	3.4457902992	0.9821655688
VTA Cre	Reward	Baseline repeat	65	2	3.3123683093	440.2380862226	0	0.9957810218
VTA Cre	Reward	Baseline repeat	65	3	3.2848948653	478.3254762562	0	0.9931375151
VTA Cre	Reward	Baseline repeat	67	1	3.3202333228	469.6953206992	9.2444433904	0.9815994496
VTA Cre	Reward	Baseline repeat	67	2	2.3254881783	439.3652703778	0	0.984612544
VTA Cre	Reward	Baseline repeat	67	3	2.6063955251	446.3662688498	0.5158235722	0.9862401533
VTA Cre	Reward	Baseline repeat	68	1	4.0593599835	439.6408759386	24.143251908	0.9235835608
VTA Cre	Reward	Baseline repeat	68	2	5.7259509282	480.2946290623	14.2236901429	0.9649056928
VTA Cre	Reward	Baseline repeat	68	3	3.9923337088	461.4019197573	12.853041444	0.9819426348
VTA Cre	Reward	Baseline repeat	71	1	1.6363101125	396.0386078798	0	0.9838839008
VTA Cre	Reward	Baseline repeat	71	2	1.8666489973	381.472879948	3.6448108696	0.9923904173
VTA Cre	Reward	Baseline repeat	71	3	1.6824976024	386.6267164505	0	0.9934991401
VTA Cre	Reward	Baseline repeat	176	1	3.2954282833	447.8706400669	0	0.9434128815
VTA Cre	Reward	Baseline repeat	176	2	2.586745125	412.622349275	0	0.9725587663
VTA Cre	Reward	Baseline repeat	176	3	2.160456333	437.8302780678	0	0.9661338683
VTA Cre	Reward	Baseline repeat	178	1	4.2035158645	461.300541016	0	0.9525827438
VTA Cre	Reward	Baseline repeat	178	2	1.1790985246	396.6987590581	0	0.881685344
VTA Cre	Reward	Baseline repeat	178	3	1.2445059594	479.6254683721	0	0.9722562499
VTA Cre	Reward	Baseline repeat	729	1	4.627363535	386.1700331418	26.1804897565	0.9765330521
VTA Cre	Reward	Baseline repeat	729	2	2.5818036107	417.5498651438	11.5524111113	0.976286206
VTA Cre	Reward	Baseline repeat	729	3	2.5136820019	372.2123211922	7.2527998273	0.9762988003
VTA Cre	Reward	Baseline repeat	732	1	13.8403463663	513.2009155814	20.4533649985	0.9032992223
VTA Cre	Reward	Baseline repeat	732	2	6.4027329034	375.2365985975	11.7181914817	0.908892543
VTA Cre	Reward	Baseline repeat	732	3	12.5286600078	456.6039782154	21.23187884	0.9408783885
VTA Cre	Reward	Cue laser	63	1	6.1165804417	497.1003167407	0	0.9592356415
VTA Cre	Reward	Cue laser	63	2	5.8027700054	510.9876432571	1.8932561144	0.9907414823

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA Cre	Reward	Cue laser	63	3	5.2687505167	526.4624973346		0 0.9702846647
VTA Cre	Reward	Cue laser	65	1	4.7839734828	462.4911525603		0 0.9500458814
VTA Cre	Reward	Cue laser	65	2	6.8532645218	546.7025754358		0 0.9904942225
VTA Cre	Reward	Cue laser	65	3	7.0441336565	549.3342891814		0 0.9907615967
VTA Cre	Reward	Cue laser	67	1	3.1390145399	423.0817180381		0 0.9969632729
VTA Cre	Reward	Cue laser	67	2	4.2418668637	476.8589709474		0 0.9808206385
VTA Cre	Reward	Cue laser	67	3	4.8011314946	504.9488118971		0 0.9975886341
VTA Cre	Reward	Cue laser	68	1	9.5401109656	557.1688234635	9.4693640501	0.9727949153
VTA Cre	Reward	Cue laser	68	2	6.1433531352	479.2365977289		0 0.9902679694
VTA Cre	Reward	Cue laser	68	3	5.1675543669	435.2754798351		0 0.984863359
VTA Cre	Reward	Cue laser	71	1	3.8959144262	414.5986647438		0 0.9581553987
VTA Cre	Reward	Cue laser	71	2	2.7046728676	383.5681527492	2.1159711313	0.9966170103
VTA Cre	Reward	Cue laser	71	3	3.7772043467	446.8152501157		0 0.9264336748
VTA Cre	Reward	Cue laser	176	1	12.3386192837	589.0644745556	9.9215578796	0.9786205546
VTA Cre	Reward	Cue laser	176	2	6.4137093737	532.3611577052		0 0.9471099548
VTA Cre	Reward	Cue laser	176	3	13.4943547284	591.7120445956	6.783023573	0.9858455826
VTA Cre	Reward	Cue laser	178	1	4.8046641185	527.9186860797		0 0.9670127446
VTA Cre	Reward	Cue laser	178	2	3.8484529009	481.0633777103		0 0.9868215552
VTA Cre	Reward	Cue laser	178	3	4.67923748	525.8362727821		0 0.9905999745
VTA Cre	Reward	Cue laser	729	1	12.3386192837	589.0644745556	9.9215578796	0.9786205546
VTA Cre	Reward	Cue laser	729	2	3.6624674123	452.7538778808		0 0.9173526605
VTA Cre	Reward	Cue laser	729	3	12.5151914691	591.074766879	12.3349932062	0.978922212
VTA Cre	Reward	Cue laser	732	1	5.1211291143	425.6528993232		0 0.975428798
VTA Cre	Reward	Cue laser	732	2	8.7431547233	506.6280903242		0 0.9598267846
VTA Cre	Reward	Cue laser	732	3	5.7472217323	431.5765602503		0 0.9596100821
VTA Cre	Reward	Reward laser	63	1	3.5704491297	505.0614818226	11.3719077182	0.9765915064
VTA Cre	Reward	Reward laser	63	2	2.3125148927	459.2750522999	7.9418026495	0.989556934
VTA Cre	Reward	Reward laser	63	3	2.3065513084	437.8695211454	0.1094782015	0.9977286637
VTA Cre	Reward	Reward laser	65	1	3.1178067746	472.3034327006	18.0044804327	0.9808316959
VTA Cre	Reward	Reward laser	65	2	2.36688082	478.2263228431	4.2152569395	0.9946502415
VTA Cre	Reward	Reward laser	65	3	3.1094701134	499.4877556185		0 0.9811197441
VTA Cre	Reward	Reward laser	67	1	1.5853660675	446.2452725434	7.4030426156	0.9968051488
VTA Cre	Reward	Reward laser	67	2	1.1493937691	439.2993568705	7.4741852929	0.9845919474
VTA Cre	Reward	Reward laser	67	3	1.4412848033	464.3972991359	8.5743230703	0.9953574614
VTA Cre	Reward	Reward laser	68	1	2.8828198032	453.8216304645	6.5475977047	0.9835902235
VTA Cre	Reward	Reward laser	68	2	1.0040131154	443.6453634394		0 0.9914299972
VTA Cre	Reward	Reward laser	68	3	1.7882138754	436.7168942419	12.7830088459	0.9844398923
VTA Cre	Reward	Reward laser	71	1	0.9876036391	372.3839278572	5.0877769102	0.9969754336
VTA Cre	Reward	Reward laser	71	2	1.8104710499	378.5418059736	13.0916487064	0.9838993691
VTA Cre	Reward	Reward laser	71	3	1.1616362848	364.7654288463		0 0.9941388418
VTA Cre	Reward	Reward laser	176	1	1.9833810217	363.614126127		0 0.7308666751
VTA Cre	Reward	Reward laser	176	2	2.950404759	382.6560665756	7.0695051455	0.9602928732
VTA Cre	Reward	Reward laser	176	3	1.7499624455	397.250396114		0 0.969598142
VTA Cre	Reward	Reward laser	178	1	3.3120396173	511.0295540651	5.1484309727	0.9726228013
VTA Cre	Reward	Reward laser	178	2	1.692313194	452.7492858722		0 0.9779318224
VTA Cre	Reward	Reward laser	178	3	3.4305137	514.34684115		0 0.9867820234
VTA Cre	Reward	Reward laser	729	1	2.3021543073	440.4843820469	19.8179739491	0.9704573531
VTA Cre	Reward	Reward laser	729	2	2.3580109994	415.7948032553	18.8743729273	0.9869338023
VTA Cre	Reward	Reward laser	729	3	2.6511433711	473.1083791847	8.3840309661	0.9883008695
VTA Cre	Reward	Reward laser	732	1	2.1081931386	476.5688948782		0 0.993309122
VTA Cre	Reward	Reward laser	732	2	1.9408199509	469.2201138736		0 0.9981393546
VTA Cre	Reward	Reward laser	732	3	2.3669466454	470.8482199672	8.3474855312	0.9852528666
VTA Cre	Cost	Baseline	63	1	1.2240382728	953.8618186844		0 0.980876495
VTA Cre	Cost	Baseline	63	2	1.4206540899	951.3297197038		0 0.9855435915
VTA Cre	Cost	Baseline	63	3	1.5137494638	920.1047912102		0 0.995110043
VTA Cre	Cost	Baseline	65	1	1.4499548114	951.4946468951		0 0.9877459847
VTA Cre	Cost	Baseline	65	2	1.0941304141	929.167791039		0 0.9917004282
VTA Cre	Cost	Baseline	65	3	1.2583321812	950.0971943877		0 0.9924797101
VTA Cre	Cost	Baseline	67	1	1.1393570141	880.8687257548		0 0.9833818571

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA Cre	Cost	Baseline	67	2	1.2231293161	886.5637422866		0 0.9903293836
VTA Cre	Cost	Baseline	67	3	1.2798226971	927.9887147365		0 0.9964568734
VTA Cre	Cost	Baseline	68	1	1.9064994156	1003.6772612506		0 0.9527125454
VTA Cre	Cost	Baseline	68	2	0.9365367809	925.3510117295		0 0.9748146805
VTA Cre	Cost	Baseline	68	3	1.1132563578	966.6563231293		0 0.9768303465
VTA Cre	Cost	Baseline	71	1	1.2199815383	919.88286115		0 0.9907928534
VTA Cre	Cost	Baseline	71	2	0.7596649438	892.0662806127		0 0.9781128823
VTA Cre	Cost	Baseline	71	3	0.9342820977	938.9071761741		0 0.9781778667
VTA Cre	Cost	Baseline	176	1	1.5854424515	983.1062163136		0 0.9746772491
VTA Cre	Cost	Baseline	176	2	1.3027305796	991.8475974224		0 0.954859976
VTA Cre	Cost	Baseline	176	3	1.2495545818	993.0643700673		0 0.9522476621
VTA Cre	Cost	Baseline	178	1	1.0341861047	969.8489589738		0 0.9467613869
VTA Cre	Cost	Baseline	178	2	2.3145940577	1048.6088260078		0 0.9355522092
VTA Cre	Cost	Baseline	178	3	1.6878982619	1014.307701298		0 0.9186222459
VTA Cre	Cost	Baseline	558	1	1.1752560259	954.7670581451		0 0.944277944
VTA Cre	Cost	Baseline	558	2	1.7422654986	964.5312759315		0 0.9630511453
VTA Cre	Cost	Baseline	558	3	1.3709608464	939.6043172995		0 0.9521757948
VTA Cre	Cost	Baseline	559	1	4.265305874	1016.4389527599	2.735332096	0.9613024109
VTA Cre	Cost	Baseline	559	2	3.5572783592	1024.6259116247		0 0.9526134492
VTA Cre	Cost	Baseline	559	3	2.9938794005	987.1630116412		0 0.9852956787
VTA Cre	Cost	Baseline	729	1	0.5873695262	917.4369730264		0 0.9598537814
VTA Cre	Cost	Baseline	729	2	0.747187485	935.8849093723		0 0.9673150681
VTA Cre	Cost	Baseline	729	3	0.7811118109	940.9426795844		0 0.9751855398
VTA Cre	Cost	Baseline	732	1	1.0181356963	984.2805889459		0 0.9832305109
VTA Cre	Cost	Baseline	732	2	1.2965466026	979.8562112498		0 0.986253581
VTA Cre	Cost	Baseline	732	3	1.0621227689	972.7520396628		0 0.9595599748
VTA Cre	Cost	Baseline repeat	63	1	1.8247891615	967.6100913541		0 0.9748124551
VTA Cre	Cost	Baseline repeat	63	2	2.6951879965	998.4290492497		0 0.9777650571
VTA Cre	Cost	Baseline repeat	63	3	2.3857963312	998.3718194514		0 0.9740625263
VTA Cre	Cost	Baseline repeat	65	1	1.1533660154	912.6606032295		0 0.9746097727
VTA Cre	Cost	Baseline repeat	65	2	1.0291658655	918.8973033824		0 0.9722999701
VTA Cre	Cost	Baseline repeat	65	3	1.0037847722	938.690615362		0 0.9823421276
VTA Cre	Cost	Baseline repeat	67	1	1.4332562293	945.5693338259		0 0.9936152957
VTA Cre	Cost	Baseline repeat	67	2	1.261992981	955.5315011685		0 0.9909990097
VTA Cre	Cost	Baseline repeat	67	3	1.4628268978	904.0525269415		0 0.9678040525
VTA Cre	Cost	Baseline repeat	68	1	1.0353787515	980.6911660549		0 0.9701427744
VTA Cre	Cost	Baseline repeat	68	2	0.9326062222	901.1559122212		0 0.9505251433
VTA Cre	Cost	Baseline repeat	68	3	0.8999404635	910.2033294708		0 0.9671586149
VTA Cre	Cost	Baseline repeat	71	1	2.3184825939	1033.3564385668		0 0.9496707207
VTA Cre	Cost	Baseline repeat	71	2	1.5699342917	944.3067746437		0 0.9757068219
VTA Cre	Cost	Baseline repeat	71	3	0.8999404635	910.2033294708		0 0.9671586149
VTA Cre	Cost	Baseline repeat	176	1	1.4447909311	985.2415310909		0 0.9656026052
VTA Cre	Cost	Baseline repeat	176	2	1.355942842	974.4939006064		0 0.9665743858
VTA Cre	Cost	Baseline repeat	176	3	1.2637603766	975.2930827456		0 0.9538182234
VTA Cre	Cost	Baseline repeat	178	1	2.5143310395	1027.4826477165		0 0.9532305592
VTA Cre	Cost	Baseline repeat	178	2	2.3184825939	1033.3564385668		0 0.9496707207
VTA Cre	Cost	Baseline repeat	178	3	2.5022827944	1034.4972791938		0 0.9596563251
VTA Cre	Cost	Baseline repeat	558	1	0.514387884	868.6615303575		0 0.9668065555
VTA Cre	Cost	Baseline repeat	558	2	0.7129726989	933.9383604475		0 0.9558964243
VTA Cre	Cost	Baseline repeat	558	3	0.6988878953	938.8273133134		0 0.9533723321
VTA Cre	Cost	Baseline repeat	559	1	2.9949628268	1054.004177133		0 0.9243073907
VTA Cre	Cost	Baseline repeat	559	2	2.4328878169	1039.7868065092		0 0.9541479319
VTA Cre	Cost	Baseline repeat	559	3	2.157046145	1019.0378449468		0 0.9376419493
VTA Cre	Cost	Baseline repeat	729	1	0.5868206083	870.141703598		0 0.974410812
VTA Cre	Cost	Baseline repeat	729	2	0.8330469302	906.9519514662		0 0.9828193793
VTA Cre	Cost	Baseline repeat	729	3	0.7368505123	906.9539795576		0 0.984516417
VTA Cre	Cost	Baseline repeat	732	1	0.8335011619	876.9712720447		0 0.9627098469
VTA Cre	Cost	Baseline repeat	732	2	0.8864320988	937.4590793298		0 0.9801814694
VTA Cre	Cost	Baseline repeat	732	3	0.9240467183	962.9636664501		0 0.9820152082

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA Cre	Cost	Cue laser	63	1	2.9572655253	1039.5459835522		0 0.9724614446
VTA Cre	Cost	Cue laser	63	2	2.7380839639	1049.1630714185		0 0.9641732269
VTA Cre	Cost	Cue laser	63	3	3.2341090385	1066.241994192		0 0.9687462095
VTA Cre	Cost	Cue laser	65	1	2.3461740769	1007.0357293585		0 0.9662650449
VTA Cre	Cost	Cue laser	65	2	2.1581135789	1018.8228801927		0 0.9784773296
VTA Cre	Cost	Cue laser	65	3	2.5217084549	1015.0073730007		0 0.9766144018
VTA Cre	Cost	Cue laser	67	1	1.54096663104	960.5766430943		0 0.9724682639
VTA Cre	Cost	Cue laser	67	2	1.9367748146	991.8915272303		0 0.9670702984
VTA Cre	Cost	Cue laser	67	3	1.8466663362	994.5341108897		0 0.9669561571
VTA Cre	Cost	Cue laser	68	1	2.9572655253	1039.5459835522		0 0.9724614446
VTA Cre	Cost	Cue laser	68	2	1.7396710535	959.0444810755		0 0.9765462277
VTA Cre	Cost	Cue laser	68	3	3.0077835779	1048.5768095596		0 0.9726278718
VTA Cre	Cost	Cue laser	71	1	1.3642435058	990.8188448745		0 0.953756241
VTA Cre	Cost	Cue laser	71	2	1.6250989783	965.5578964773		0 0.975235937
VTA Cre	Cost	Cue laser	71	3	0.832566139	828.9616580183		0 0.8895682892
VTA Cre	Cost	Cue laser	176	1	2.2060534446	1027.3799432297		0 0.9433752447
VTA Cre	Cost	Cue laser	176	2	2.343723238	1052.233875687		0 0.944321678
VTA Cre	Cost	Cue laser	176	3	3.2451270867	1071.1467725226		0 0.9633453053
VTA Cre	Cost	Cue laser	178	1	2.0195113109	1047.1126415942		0 0.9162527733
VTA Cre	Cost	Cue laser	178	2	1.7554605529	1022.9355725364		0 0.8838793751
VTA Cre	Cost	Cue laser	178	3	1.8371829773	1038.4352696252		0 0.8967809939
VTA Cre	Cost	Cue laser	558	1	1.1833531681	963.4604403562		0 0.9378770078
VTA Cre	Cost	Cue laser	558	2	0.9421683353	919.7564298317		0 0.9747686158
VTA Cre	Cost	Cue laser	558	3	1.5896828011	929.0930012324		0 0.9539853667
VTA Cre	Cost	Cue laser	559	1	7.8975967916	1147.6932795654		0 0.931013242
VTA Cre	Cost	Cue laser	559	2	4.3621071729	1056.8860315973		0 0.9646741862
VTA Cre	Cost	Cue laser	559	3	4.313726436	1095.7875480782		0 0.9383646177
VTA Cre	Cost	Cue laser	729	1	1.1778621755	954.850666695		0 0.9733401814
VTA Cre	Cost	Cue laser	729	2	2.9572655253	1039.5459835522		0 0.9724614446
VTA Cre	Cost	Cue laser	729	3	1.3155862839	961.1348213914		0 0.9925317132
VTA Cre	Cost	Cue laser	732	1	1.4403886745	994.3509421112		0 0.973471754
VTA Cre	Cost	Cue laser	732	2	1.6522131403	1026.8144832905		0 0.9403115738
VTA Cre	Cost	Cue laser	732	3	1.6032531856	1017.214891803		0 0.9708937585
VTA Cre	Cost	Reward laser	63	1	0.3382885053	910.938586264		0 0.9505670907
VTA Cre	Cost	Reward laser	63	2	0.9076715875	951.3824307004		0 0.9884874751
VTA Cre	Cost	Reward laser	63	3	0.6203727786	933.6104869926		0 0.980371937
VTA Cre	Cost	Reward laser	65	1	0.542211168	893.475613428		0 0.9938017729
VTA Cre	Cost	Reward laser	65	2	0.4656254961	868.0368538666	40.5195760415	0.9928940101
VTA Cre	Cost	Reward laser	65	3	0.6862494299	898.9793760351	19.659891619	0.9822808876
VTA Cre	Cost	Reward laser	67	1	0.5604173871	918.2150909774		0 0.9738163316
VTA Cre	Cost	Reward laser	67	2	0.650209297	939.0706956921		0 0.9741249819
VTA Cre	Cost	Reward laser	67	3	0.6316665449	928.3963590767		0 0.9821609342
VTA Cre	Cost	Reward laser	68	1	0.4039081935	907.7947502606		0 0.9836136148
VTA Cre	Cost	Reward laser	68	2	0.4629068692	924.3656528989		0 0.9835801841
VTA Cre	Cost	Reward laser	68	3	0.5618808517	935.9312608971		0 0.9855218911
VTA Cre	Cost	Reward laser	71	1	0.5629790388	942.9417282544		0 0.9199168789
VTA Cre	Cost	Reward laser	71	2	0.3456881076	889.7248986439		0 0.9883530949
VTA Cre	Cost	Reward laser	71	3	0.5138714816	913.1726787542	73.8944338993	0.9665512544
VTA Cre	Cost	Reward laser	176	1	0.5055000125	887.3200623796		0 0.9943825655
VTA Cre	Cost	Reward laser	176	2	0.9786478371	956.0961580201		0 0.9683660092
VTA Cre	Cost	Reward laser	176	3	1.0148383103	946.694265512		0 0.9880809397
VTA Cre	Cost	Reward laser	178	1	0.7995677397	924.6948154209		0 0.9596482181
VTA Cre	Cost	Reward laser	178	2	1.035871878	916.3474682141		0 0.9850764724
VTA Cre	Cost	Reward laser	178	3	1.3642435058	990.8188448745		0 0.953756241
VTA Cre	Cost	Reward laser	558	1	0.5381672964	916.5664495137		0 0.9934430489
VTA Cre	Cost	Reward laser	558	2	0.5491263728	910.540023249	20.1974173094	0.9928060115
VTA Cre	Cost	Reward laser	558	3	0.5852783486	901.4510020845		0 0.989625401
VTA Cre	Cost	Reward laser	559	1	0.6704308747	932.2339889118		0 0.9846850164
VTA Cre	Cost	Reward laser	559	2	0.4119356261	887.2344944707		0 0.9919047498

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA Cre	Cost	Reward laser	559	3	0.5604173871	918.2150909774		0 0.9738163316
VTA Cre	Cost	Reward laser	729	1	0.559126081	933.2415191732		0 0.9709390585
VTA Cre	Cost	Reward laser	729	2	0.5266172077	894.0384870951		0 0.982807896
VTA Cre	Cost	Reward laser	729	3	0.5424474667	901.0085496208		0 0.9707946986
VTA Cre	Cost	Reward laser	732	1	0.6277037923	949.5978713087		0 0.9748688304
VTA Cre	Cost	Reward laser	732	2	0.699067568	952.8346678873		0 0.9779392918
VTA Cre	Cost	Reward laser	732	3	0.7251751609	962.7416611303		0 0.9729920465
VTA WT	Reward	Baseline	2	1	7.0413370008	508.7004586825	23.5240382219	0.9833010241
VTA WT	Reward	Baseline	2	2	2.6104155395	385.9864321871	4.9699312294	0.9889006013
VTA WT	Reward	Baseline	2	3	2.754174986	371.5665063511	1.5600188149	0.9907941173
VTA WT	Reward	Baseline	4	1	1.7048071378	459.2518226415	0.8015096029	0.9959402947
VTA WT	Reward	Baseline	4	2	2.268808784	456.7980236333	12.2265058613	0.9936383407
VTA WT	Reward	Baseline	4	3	1.9271926563	458.6045338009	0.2031807653	0.9940190351
VTA WT	Reward	Baseline	5	1	4.9801920952	430.5911054033	2.1280829009	0.9200098055
VTA WT	Reward	Baseline	5	2	2.6966688401	368.0350912962		0 0.9313398072
VTA WT	Reward	Baseline	5	3	2.0663523775	347.1122854519		0 0.9788605722
VTA WT	Reward	Baseline	6	1	2.213209646	413.1955299625		0 0.9829084233
VTA WT	Reward	Baseline	6	2	2.7159400688	464.285338231	0.5962637449	0.9920352081
VTA WT	Reward	Baseline	6	3	3.1373138886	395.3926263954	7.4809458883	0.9766555683
VTA WT	Reward	Baseline	18	1	3.6163640594	497.6246785971		0 0.9693612618
VTA WT	Reward	Baseline	18	2	4.051043558	482.9508048212	3.5444429801	0.9973505142
VTA WT	Reward	Baseline	18	3	3.4506654938	454.4988880613		0 0.977522719
VTA WT	Reward	Baseline	19	1	3.1705662843	431.842861549		0 0.9652266207
VTA WT	Reward	Baseline	19	2	4.9144744059	453.6526814206		0 0.9968838212
VTA WT	Reward	Baseline	19	3	5.2196852788	517.5031289464		0 0.9810291682
VTA WT	Reward	Baseline	25	1	2.0808207965	429.9206982314		0 0.9664866662
VTA WT	Reward	Baseline	25	2	2.4838625846	384.1603444796		0 0.9807690983
VTA WT	Reward	Baseline	25	3	1.8162553142	366.6698083516		0 0.9876698958
VTA WT	Reward	Baseline	26	1	5.6133404365	307.5810506141	5.5216527034	0.9925746028
VTA WT	Reward	Baseline	26	2	3.598536707	307.3864913776	0.312159429	0.9669633474
VTA WT	Reward	Baseline	26	3	3.0445420187	352.3166785482		0 0.9788219529
VTA WT	Reward	Baseline repeat	2	1	2.888182663	304.7322214671	10.9676629935	0.9520836476
VTA WT	Reward	Baseline repeat	2	2	2.1681938001	456.2509721172	3.1881945748	0.990997496
VTA WT	Reward	Baseline repeat	2	3	2.0493194946	441.6879006683		0 0.9960211417
VTA WT	Reward	Baseline repeat	4	1	2.4812968484	483.7274568845	3.4772047821	0.9907284523
VTA WT	Reward	Baseline repeat	4	2	2.8931451315	476.9088448651	5.3395278945	0.9895555377
VTA WT	Reward	Baseline repeat	4	3	2.4005994725	365.8890356691		0 0.9824515089
VTA WT	Reward	Baseline repeat	5	1	3.3363038779	510.2679219481		0 0.973425974
VTA WT	Reward	Baseline repeat	5	2	2.8072264542	466.4470837782		0 0.9677749357
VTA WT	Reward	Baseline repeat	5	3	3.7542495986	497.2651807399		0 0.9765506276
VTA WT	Reward	Baseline repeat	6	1	2.4563145595	437.5241670043	7.8420799508	0.99192591
VTA WT	Reward	Baseline repeat	6	2	7.1979322079	498.4456342135	21.9577009876	0.9773475727
VTA WT	Reward	Baseline repeat	6	3	5.5440664919	501.1026811511	16.955180538	0.9815096819
VTA WT	Reward	Baseline repeat	18	1	2.947098487	379.4782946701		0 0.9437759378
VTA WT	Reward	Baseline repeat	18	2	2.4936362574	485.6482186469		0 0.9964241509
VTA WT	Reward	Baseline repeat	18	3	3.8075744385	507.6032959818	3.2777973653	0.9788315058
VTA WT	Reward	Baseline repeat	19	1	2.5417582411	477.9380303633		0 0.9910066924
VTA WT	Reward	Baseline repeat	19	2	6.2666063383	515.9107231414		0 0.9526431464
VTA WT	Reward	Baseline repeat	19	3	4.3723387097	488.4957253127		0 0.9924708812
VTA WT	Reward	Baseline repeat	25	1	3.1429744005	419.9574584634		0 0.9738132495
VTA WT	Reward	Baseline repeat	25	2	2.5955998933	419.6665589348		0 0.9855422813
VTA WT	Reward	Baseline repeat	25	3	2.2574645742	397.3126782937		0 0.9949219614
VTA WT	Reward	Baseline repeat	26	1	4.877726259	397.3727818808		0 0.9480417307
VTA WT	Reward	Baseline repeat	26	2	3.4470880758	430.1581666693		0 0.9594325594
VTA WT	Reward	Baseline repeat	26	3	2.7884982827	416.3858193719		0 0.9833834144
VTA WT	Reward	Cue laser	2	1	2.6075256249	432.8433915989	5.9902480451	0.989305864
VTA WT	Reward	Cue laser	2	2	2.6024337411	479.9993059808	3.9945771609	0.9947960606
VTA WT	Reward	Cue laser	2	3	1.7423659962	454.4976222116	2.3588000714	0.9948564718
VTA WT	Reward	Cue laser	4	1	3.1461908376	503.4165969809	7.1512495846	0.9861157616

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA WT	Reward	Cue laser	4	2	2.0651478466	471.0966522514	7.1057843593	0.9836190261
VTA WT	Reward	Cue laser	4	3	2.1055787391	480.4045472928	8.864100659	0.9808175723
VTA WT	Reward	Cue laser	5	1	2.8211266256	465.8620803995	0	0.9774987031
VTA WT	Reward	Cue laser	5	2	3.1538393055	485.6236523738	0	0.9962947974
VTA WT	Reward	Cue laser	5	3	4.7775262777	523.9365880349	0	0.9886241435
VTA WT	Reward	Cue laser	6	1	2.6863159069	415.7343682644	0	0.9947217762
VTA WT	Reward	Cue laser	6	2	3.1147483705	437.5259166683	15.6591536827	0.9638339774
VTA WT	Reward	Cue laser	6	3	3.1482516383	453.5121346771	9.1012054628	0.9688646516
VTA WT	Reward	Cue laser	18	1	2.1017130188	430.6837256752	0	0.9926360209
VTA WT	Reward	Cue laser	18	2	2.7351334441	476.1345314013	0	0.9875613886
VTA WT	Reward	Cue laser	18	3	3.0261619739	495.346631567	0	0.9874268139
VTA WT	Reward	Cue laser	19	1	3.1705662843	431.842861549	0	0.9652266207
VTA WT	Reward	Cue laser	19	2	2.4470712444	492.1943856273	0	0.9634669432
VTA WT	Reward	Cue laser	19	3	2.4676534017	486.6155313287	0	0.9803059785
VTA WT	Reward	Cue laser	25	1	2.2746779614	396.6480703086	0	0.994755549
VTA WT	Reward	Cue laser	25	2	2.5936734792	397.9225147296	0	0.9667073893
VTA WT	Reward	Cue laser	25	3	2.4263420198	398.4742707267	0	0.9953002735
VTA WT	Reward	Cue laser	26	1	2.5116120569	341.9675509392	0	0.9103334972
VTA WT	Reward	Cue laser	26	2	4.2203710256	405.3701036791	0	0.9863672929
VTA WT	Reward	Cue laser	26	3	4.6827425936	415.6026245307	3.6407203166	0.9822761608
VTA WT	Reward	Reward laser	2	1	1.9301474269	461.7056138824	4.0967749653	0.9873221842
VTA WT	Reward	Reward laser	2	2	2.796049506	451.1274709817	18.7002941875	0.9840351074
VTA WT	Reward	Reward laser	2	3	2.7146140342	483.1700850154	23.0703517893	0.9704417215
VTA WT	Reward	Reward laser	4	1	2.8149603946	477.5237822246	0.875934409	0.9879683255
VTA WT	Reward	Reward laser	4	2	1.7093971544	390.4929166707	11.718679959	0.975740687
VTA WT	Reward	Reward laser	4	3	2.9263871878	471.2417777856	9.9383657171	0.993702276
VTA WT	Reward	Reward laser	5	1	3.4897146433	498.348681178	0	0.9603843414
VTA WT	Reward	Reward laser	5	2	6.0132046416	484.5344015141	0	0.954541367
VTA WT	Reward	Reward laser	5	3	5.7917274149	546.9044957148	0	0.9674133729
VTA WT	Reward	Reward laser	6	1	3.7954723788	467.5884337411	11.2831756164	0.9912440588
VTA WT	Reward	Reward laser	6	2	4.6710936104	523.2988735616	9.65959936	0.9820660561
VTA WT	Reward	Reward laser	6	3	2.9377053544	468.331925218	0	0.996423486
VTA WT	Reward	Reward laser	18	1	3.8767484932	496.839382908	0	0.9870108724
VTA WT	Reward	Reward laser	18	2	3.5425428451	488.0640704265	0	0.9759939326
VTA WT	Reward	Reward laser	18	3	3.6550976938	488.8767421031	0	0.9982099729
VTA WT	Reward	Reward laser	19	1	2.6609664579	455.0732922655	0	0.9909436778
VTA WT	Reward	Reward laser	19	2	4.4467170384	508.2052065277	0	0.9866512359
VTA WT	Reward	Reward laser	19	3	2.5417582411	477.9380303633	0	0.9910066924
VTA WT	Reward	Reward laser	25	1	2.811715038	405.5770093968	2.6722464176	0.9824012583
VTA WT	Reward	Reward laser	25	2	2.4340752477	410.2221086203	0	0.9891393337
VTA WT	Reward	Reward laser	25	3	2.7435929769	425.6467688717	0	0.9746165174
VTA WT	Reward	Reward laser	26	1	4.2092453614	426.8318272561	0	0.9841259513
VTA WT	Reward	Reward laser	26	2	4.1428652264	425.7716510417	0	0.9855856062
VTA WT	Reward	Reward laser	26	3	4.2230016728	423.2881942498	0	0.9740289583
VTA WT	Cost	Baseline	2	1	0.8280740457	923.4550785464	0	0.9882347245
VTA WT	Cost	Baseline	2	2	0.7513683679	919.4224751659	0	0.987621146
VTA WT	Cost	Baseline	2	3	0.7584508818	905.3770617314	0	0.9836087341
VTA WT	Cost	Baseline	4	1	0.3800263108	924.6727299817	0	0.9350882204
VTA WT	Cost	Baseline	4	2	0.5370395438	954.486298137	0	0.9067131923
VTA WT	Cost	Baseline	4	3	0.3931775083	905.1765124435	0	0.9230163228
VTA WT	Cost	Baseline	5	1	0.3104033899	894.4286078385	0	0.9641968557
VTA WT	Cost	Baseline	5	2	0.3464822793	893.1026335567	0	0.9854829731
VTA WT	Cost	Baseline	5	3	0.2913018779	881.9139541766	0	0.9730157938
VTA WT	Cost	Baseline	6	1	1.8374866473	1005.6892807581	0	0.9470902425
VTA WT	Cost	Baseline	6	2	2.5172879418	1027.4632582116	0	0.9497373001
VTA WT	Cost	Baseline	6	3	1.7884238522	908.3995535024	0	0.9458344585
VTA WT	Cost	Baseline	18	1	1.0017243081	950.3876471925	0	0.978144057
VTA WT	Cost	Baseline	18	2	1.0330495416	972.0214997506	0	0.9572537462
VTA WT	Cost	Baseline	18	3	0.9342534002	931.3171150508	0	0.9541870315

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA WT	Cost	Baseline	19	1	2.2911183549	1008.5330045728		0 0.9702207837
VTA WT	Cost	Baseline	19	2	2.3303806453	1023.0822272171		0 0.9777677116
VTA WT	Cost	Baseline	19	3	1.9716884159	997.8118261823		0 0.9740443668
VTA WT	Cost	Baseline	25	1	0.9278687975	909.1155272713		0 0.9914585169
VTA WT	Cost	Baseline	25	2	1.4115209871	951.4136672891		0 0.9889048209
VTA WT	Cost	Baseline	25	3	1.3439163202	939.1406428681		0 0.9872636396
VTA WT	Cost	Baseline	26	1	4.9410216988	1050.8025243201		0 0.9872540338
VTA WT	Cost	Baseline	26	2	5.1790403896	989.5151799554		0 0.9509616955
VTA WT	Cost	Baseline	26	3	2.8061363207	976.2149027438		0 0.966319263
VTA WT	Cost	Baseline repeat	2	1	0.6434089757	901.3880253544		0 0.9933278337
VTA WT	Cost	Baseline repeat	2	2	0.6535038257	896.207537972		0 0.9943516664
VTA WT	Cost	Baseline repeat	2	3	0.6989503068	910.4238010567		0 0.9933057079
VTA WT	Cost	Baseline repeat	4	1	0.3382885053	910.938586264		0 0.9505670907
VTA WT	Cost	Baseline repeat	4	2	0.4466163854	945.2445220863		0 0.9190287286
VTA WT	Cost	Baseline repeat	4	3	0.2822153132	899.1627040147		0 0.9035966463
VTA WT	Cost	Baseline repeat	5	1	0.7487590866	930.4099346801		0 0.9705416498
VTA WT	Cost	Baseline repeat	5	2	0.5461185534	941.6421123778		0 0.9673234019
VTA WT	Cost	Baseline repeat	5	3	0.3507183684	916.9417260029		0 0.9315240338
VTA WT	Cost	Baseline repeat	6	1	1.5031393019	892.3778130733		0 0.9387818077
VTA WT	Cost	Baseline repeat	6	2	1.98657646	1027.9892281965		0 0.9123687027
VTA WT	Cost	Baseline repeat	6	3	2.4919776649	1005.7914031788		0 0.9499467859
VTA WT	Cost	Baseline repeat	18	1	1.5518950098	996.0766026258		0 0.9474826646
VTA WT	Cost	Baseline repeat	18	2	1.4757259851	998.9217046354		0 0.9486881763
VTA WT	Cost	Baseline repeat	18	3	1.6381829358	997.784771911		0 0.9509237093
VTA WT	Cost	Baseline repeat	19	1	1.9154679028	1005.6435639914		0 0.9818829826
VTA WT	Cost	Baseline repeat	19	2	2.0204195392	1000.7996293233		0 0.9582707915
VTA WT	Cost	Baseline repeat	19	3	2.2616666614	1029.2805756464		0 0.9659186123
VTA WT	Cost	Baseline repeat	25	1	1.6557592556	976.6842558951		0 0.9724108635
VTA WT	Cost	Baseline repeat	25	2	1.097357411	942.0081320774		0 0.9803403568
VTA WT	Cost	Baseline repeat	25	3	1.6820853893	994.5297442765		0 0.9604654881
VTA WT	Cost	Baseline repeat	26	1	5.2551478298	1084.0651901953		0 0.9590781253
VTA WT	Cost	Baseline repeat	26	2	3.7513873093	1054.6247306326		0 0.9830165808
VTA WT	Cost	Baseline repeat	26	3	4.0292512196	1037.1020266762		0 0.9595338219
VTA WT	Cost	Cue laser	2	1	0.7666943718	906.6560088994		0 0.9969151895
VTA WT	Cost	Cue laser	2	2	0.8550692124	919.7669410663		0 0.9885037259
VTA WT	Cost	Cue laser	2	3	0.8767944841	908.2697772608	19.0936604492	0.9856555685
VTA WT	Cost	Cue laser	4	1	0.521303336	932.7947999127		0 0.9347459224
VTA WT	Cost	Cue laser	4	2	0.697149488	948.7899740051		0 0.9456382656
VTA WT	Cost	Cue laser	4	3	0.4723942301	932.6751887093		0 0.9633080574
VTA WT	Cost	Cue laser	5	1	0.2950373457	891.8513195111		0 0.9604108092
VTA WT	Cost	Cue laser	5	2	0.301579204	886.3771100912		0 0.9517590938
VTA WT	Cost	Cue laser	5	3	0.2866944151	878.4464539001		0 0.9700014023
VTA WT	Cost	Cue laser	6	1	2.2503953746	1035.8710966953		0 0.9432249018
VTA WT	Cost	Cue laser	6	2	1.894493134	1023.7475382147		0 0.9008042331
VTA WT	Cost	Cue laser	6	3	1.695093459	1001.9561798886		0 0.9430572017
VTA WT	Cost	Cue laser	18	1	0.9509437971	976.8078552903		0 0.9506151369
VTA WT	Cost	Cue laser	18	2	0.9128597482	972.6665082737		0 0.9569865745
VTA WT	Cost	Cue laser	18	3	1.0460977316	996.2001624979		0 0.9382959637
VTA WT	Cost	Cue laser	19	1	2.9849268949	1056.7963771947		0 0.9636654348
VTA WT	Cost	Cue laser	19	2	1.6609053075	1016.449356627		0 0.9316362606
VTA WT	Cost	Cue laser	19	3	1.8046124213	1007.9184195967		0 0.9703920603
VTA WT	Cost	Cue laser	25	1	1.6586644387	975.6805370135		0 0.9741820886
VTA WT	Cost	Cue laser	25	2	1.2408444723	936.6761591171		0 0.9802999504
VTA WT	Cost	Cue laser	25	3	1.2722571635	937.7973456541		0 0.9687501768
VTA WT	Cost	Cue laser	26	1	3.5036549572	1039.0449537599		0 0.9759192393
VTA WT	Cost	Cue laser	26	2	4.3156374045	1047.3604813221		0 0.9662186944
VTA WT	Cost	Cue laser	26	3	3.6327140346	1035.1806222418		0 0.9766173314
VTA WT	Cost	Reward laser	2	1	0.7423734257	909.5715625173		0 0.9723710026
VTA WT	Cost	Reward laser	2	2	0.5282831885	911.8453130271		0 0.9868125999

Table S5: Parameter estimates from nonlinear fits

Condition	Task	Treatment	ID	Replicate	alpha	Qmax	Qmin	R2
VTA WT	Cost	Reward laser	2	3	2.5461346066	1010.2559133237		0 0.9725304576
VTA WT	Cost	Reward laser	4	1	0.5540673445	935.6643471137		0 0.9770607534
VTA WT	Cost	Reward laser	4	2	0.4241733254	913.527562371		0 0.9310785863
VTA WT	Cost	Reward laser	4	3	0.3863352322	927.1092221008		0 0.9377401521
VTA WT	Cost	Reward laser	5	1	0.2907499284	892.3332702533		0 0.9135823835
VTA WT	Cost	Reward laser	5	2	0.4613577443	937.449941461		0 0.9331845825
VTA WT	Cost	Reward laser	5	3	0.4937361655	936.1800149052		0 0.9498256196
VTA WT	Cost	Reward laser	6	1	1.6153370019	1001.0402787521		0 0.9409604527
VTA WT	Cost	Reward laser	6	2	0.9075386521	934.6780924842		0 0.9869785148
VTA WT	Cost	Reward laser	6	3	1.5592845141	992.2221721369		0 0.9492222026
VTA WT	Cost	Reward laser	18	1	3.0804829682	1079.0332896681		0 0.9330467368
VTA WT	Cost	Reward laser	18	2	0.9851610964	975.0730793773		0 0.9637837312
VTA WT	Cost	Reward laser	18	3	0.8938034035	965.8610579008		0 0.9678352806
VTA WT	Cost	Reward laser	19	1	2.4516005774	1029.2295642379		0 0.9557083658
VTA WT	Cost	Reward laser	19	2	1.7141761942	988.1273021417		0 0.9794432272
VTA WT	Cost	Reward laser	19	3	1.6565548447	991.5250060935		0 0.9364784559
VTA WT	Cost	Reward laser	25	1	1.2262519142	979.3622382468		0 0.9587807419
VTA WT	Cost	Reward laser	25	2	1.6863132563	997.4809938		0 0.9595553146
VTA WT	Cost	Reward laser	25	3	1.5326583262	990.402014137		0 0.9618016743
VTA WT	Cost	Reward laser	26	1	3.4217486876	1039.7361735405		0 0.9701383365
VTA WT	Cost	Reward laser	26	2	4.8578600188	1067.5493233384		0 0.976569854
VTA WT	Cost	Reward laser	26	3	4.5292671936	1059.7314875664		0 0.968178723

Table S6; Stat Table For Fig. 4B

A**Wild-type Alpha Cost Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.992

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	0.382	0.77
Replicate	2	0.592	0.583
Residual	6		
Total	11		

C**VTA Alpha Cost Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.577

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	152.888	<0.001
Replicate	2	0.652	0.554
Residual	6		
Total	11		

Comparison	Diff of Means	t	P
Cue Laser vs. Reward Laser	1.688	21.41	<0.001
Baseline Repeat vs. Cue Laser	0.88	11.159	<0.001
Cue Laser vs. Baseline	0.861	10.918	<0.001
Baseline vs. Reward Laser	0.827	10.492	<0.001
Baseline vs. Baseline Repeat	0.019	0.241	1
Baseline Repeat vs. Reward Laser	0.808	10.251	<0.001

E**Bilateral NAcc Cost Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.321

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	89.011	<0.001
Replicate	2	0.881	0.462
Residual	6		
Total	11		

Comparison	Diff of Means	t	P
Cue Laser vs. Reward Laser	2.322	16.032	<0.001
Baseline Repeat vs. Cue Laser	1.538	10.621	<0.001
Cue Laser vs. Baseline	1.403	9.686	<0.001
Baseline vs. Reward Laser	0.919	6.346	0.004
Baseline vs. Baseline Repeat	0.135	0.935	1
Baseline Repeat vs. Reward Laser	0.784	5.411	0.01

B**Wild-type Alpha Reward Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.379

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	1.755	0.255
Replicate	2	0.347	0.72
Residual	6		
Total	11		

D**VTA Alpha Reward Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.436

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	50.868	<0.001
Replicate	2	8.363	0.018
Residual	6		
Total	11		

Comparison	Diff of Means	t	P
Cue Laser vs. Reward Laser	4.205	12.209	<0.001
Baseline Repeat vs. Cue Laser	2.564	7.444	0.002
Cue Laser vs. Baseline	2.557	7.424	0.002
Baseline vs. Reward Laser	1.648	4.785	0.018
Baseline vs. Baseline Repeat	0.00668	0.0194	1
Baseline Repeat vs. Reward Laser	1.641	4.766	0.019

F**Bilateral NAcc Reward Task**

Stats used for Figure 4B: Two Way Repeated Measures Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.330

Brown-Forsyth: Passed, p=1.000

Source of Variation	DF	F	P
Condition	3	2.725	0.137
Replicate	2	0.329	0.732
Residual	6		
Total	11		

Table S7: Summary of Bayesian posterior estimates of alpha

Condition	Task	Treatment	MAP estimate	CI_lo	CI_hi
VTA WT	Cost	Baseline	1.1166182426	1.0169483264	1.2767974004
VTA WT	Cost	Cue laser	1.1327693926	1.016025725	1.2750133595
VTA WT	Cost	Baseline repeat	1.2250219176	1.0910530413	1.3597145449
VTA WT	Cost	Reward laser	1.1428872058	1.0357243694	1.2897926561
VTA WT	Reward	Baseline	3.3120207735	3.1072963374	3.5466150031
VTA WT	Reward	Cue laser	2.6804710164	2.5148433903	2.8461800434
VTA WT	Reward	Baseline repeat	3.0758190542	2.9002053192	3.2965745171
VTA WT	Reward	Reward laser	3.0332842265	2.8588977018	3.2298584994
VTA Cre	Cost	Baseline	1.3215140364	1.2497299047	1.4041229624
VTA Cre	Cost	Cue laser	1.9277877738	1.8246865642	2.0392147558
VTA Cre	Cost	Baseline repeat	1.3129951949	1.2415341844	1.397913381
VTA Cre	Cost	Reward laser	0.6648778361	0.6231264499	0.7022738732
VTA Cre	Reward	Baseline	3.3046704794	3.0990461972	3.5286566409
VTA Cre	Reward	Cue laser	4.9042509719	4.6065216897	5.2271569666
VTA Cre	Reward	Baseline repeat	3.0573530523	2.8391585845	3.2712543242
VTA Cre	Reward	Reward laser	2.0098893136	1.8705549296	2.1379123996
NAcc Cre	Cost	Baseline	1.4241777627	1.3213806776	1.5237738407
NAcc Cre	Cost	Cue laser	2.2803774294	2.1192996977	2.4484827016
NAcc Cre	Cost	Baseline repeat	1.4711031794	1.372087049	1.5880940552
NAcc Cre	Cost	Reward laser	0.7760555311	0.7209598705	0.8413865709
NAcc Cre	Reward	Baseline	2.2861547618	2.129665292	2.4952337968
NAcc Cre	Reward	Cue laser	2.4537989673	2.296098864	2.641419695
NAcc Cre	Reward	Baseline repeat	2.5232522436	2.3500122927	2.7255895915
NAcc Cre	Reward	Reward laser	1.8930367898	1.7418334206	2.0557090278

Table S8: Summary of alpha effect sizes from the Bayesian analysis

Condition	Task	Treatment	MAP estimate	CI_lo	CI_hi
Bilateral Cre	Reward	Cue laser	0.9984614584	0.8943202777	1.167448421
Bilateral Cre	Reward	Reward laser	0.7738912979	0.6780126766	0.906706746
Bilateral Cre	Cost	Cue laser	1.5636213627	1.407896759	1.7497878002
Bilateral Cre	Cost	Reward laser	0.5333768254	0.4825910056	0.6009872302
VTA Cre	Reward	Cue laser	1.5365709578	1.3734796855	1.741153912
VTA Cre	Reward	Reward laser	0.6200727468	0.5585327336	0.7114823515
VTA Cre	Cost	Cue laser	1.462826222	1.3439505216	1.5862782431
VTA Cre	Cost	Reward laser	0.5031298417	0.4594616282	0.5455190492
VTA WT	Reward	Cue laser	0.8294827658	0.7465489491	0.9324056326
VTA WT	Reward	Reward laser	0.9375891324	0.850171285	1.0638614371
VTA WT	Cost	Cue laser	0.9706071164	0.8142725789	1.1496791839
VTA WT	Cost	Reward laser	0.9724958341	0.8264087979	1.1648264095

Table S9: Summary of Bayesian posterior estimates of Qmax

Condition	Task	MAP estimate	CI_lo	CI_hi
VTA WT	Cost	926.743784234	906.5301196434	947.2974149121
VTA Cre	Cost	944.2484636912	932.5463690869	955.1261767989
NAcc Cre	Cost	934.6910667392	920.3513194486	948.5179709702
VTA WT	Reward	439.5615302301	432.2977981664	446.9619404955
VTA Cre	Reward	437.9868121327	430.4237680632	445.4541466417
NAcc Cre	Reward	412.4115684959	404.8274792479	419.5204985836

Table S10: Summary of Bayesian posterior estimates of Qmin

Condition	Task	MAP estimate	CI_lo	CI_hi
VTA WT	Cost	0.007628649	0.0019086491	4.8117882223
VTA Cre	Cost	0.0060481322	0.0017843654	1.3091034615
NAcc Cre	Cost	0.0066328128	0.0017713092	1.640803496
VTA WT	Reward	0.0095369099	0.0020615273	2.9178925432
VTA Cre	Reward	0.0093757199	0.0020318228	3.3965377758
NAcc Cre	Reward	0.0285269109	0.0041572478	8.1452443463

Table S11: Effect sizes for relative change in Qmax from Bayesian analysis

Condition	Task	MAP estimate	CI_lo	CI_hi
Bilateral Cre	Reward	0.9379369602	0.9152050686	0.9606622516
Bilateral Cre	Cost	1.0082513687	0.9819006938	1.036130706
VTA Cre	Reward	0.9951399938	0.9725783544	1.0199557902
VTA Cre	Cost	1.0177735979	0.9926514482	1.0443951941

Table S12; Stat Table For Fig. 6

A Cue Stimulation Voltammetry Cost task

Stats used for Figure 6A: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	173.042	<0.001
Residual	30		
Total	39		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue vs. Reward, 0.022	65.085	8.510	<0.001
Cue vs. Reward, 0.067	124.431	16.270	<0.001
Cue vs. Reward, 0.133	138.108	16.118	<0.001
Cue vs. Reward, 0.222	147.589	19.298	<0.001
Cue vs. Reward, 0.400	150.809	19.719	<0.001

B Cue Stimulation Voltammetry Reward task

Stats used for Figure 6C: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	218.389	<0.001
Residual	30		
Total	39		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue vs. Reward, 0.022	157.166	17.814	<0.001
Cue vs. Reward, 0.067	158.897	17.330	<0.001
Cue vs. Reward, 0.133	177.737	20.145	<0.001
Cue vs. Reward, 0.222	189.280	21.454	<0.001
Cue vs. Reward, 0.400	185.615	21.038	<0.001

Table S13; Stat Table For Fig. 7**A Conc. at Cue Voltammetry, cost task**

Stats used for Figure 7C: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	42.636	<0.001
Residual	55		
Total	64		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue-Stim vs. No stim. 0.022	12.1	1.44	1
Cue-Stim vs. No stim. 0.067	37	4.406	0.002
Cue-Stim vs. No stim. 0.133	61.2	7.288	<0.001
Cue-Stim vs. No stim. 0.222	83.8	9.98	<0.001
Cue-Stim vs. No stim. 0.400	65.2	7.768	<0.001

C Conc. at Reward Voltammetry, cost task

Stats used for Figure 7E: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	109.112	<0.001
Residual	55		
Total	64		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue-Stim vs. No stim. 0.022	12.6	2.262	1
Cue-Stim vs. No stim. 0.067	33.3	5.994	<0.001
Cue-Stim vs. No stim. 0.133	22.2	3.996	0.009
Cue-Stim vs. No stim. 0.222	19.2	3.453	0.048
Cue-Stim vs. No stim. 0.400	4.91	0.882	1

E Average cost vs. reward, no stimulation

Stats used for Figure 7A: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	3	18.635	<0.001
Residual	12		
Total	15		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue vs. Reward, Cost	58.216	6.300	<0.001
Cue vs. Reward, Reward	34.384	3.721	<0.001
Cost Cue vs. Reward Cue	21.980	2.379	0.141
Cost Rew vs. Reward Rew	1.852	0.200	1.000

B Conc. at Cue Voltammetry, reward task

Stats used for Figure 7D: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	582.94	<0.001
Residual	55		
Total	64		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue-Stim vs. No stim. 0.022	29.699	1.248	1
Cue-Stim vs. No stim. 0.067	86	3.859	<0.001
Cue-Stim vs. No stim. 0.133	93.040	3.987	<0.001
Cue-Stim vs. No stim. 0.222	129.521	5.554	<0.001
Cue-Stim vs. No stim. 0.400	142.351	6.078	<0.001

D Conc. at Reward Voltammetry, reward task

Stats used for Figure 7E: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	9	508.483	<0.001
Residual	55		
Total	64		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue-Stim vs. No stim. 0.022	47.078	20.461	<0.001
Cue-Stim vs. No stim. 0.067	24.655	14.734	<0.001
Cue-Stim vs. No stim. 0.133	29.546	11.87	0.041
Cue-Stim vs. No stim. 0.222	17.732	10.301	0.056
Cue-Stim vs. No stim. 0.400	12.889	6.177	0.308

F Average cost vs. reward, with stimulation

Stats used for Figure 7C: One Way Anova

Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	3	178.835	<0.001
Residual	12		
Total	15		

Comparison (Condition, Unit-Price)	Diff of Means	t	P
Cue vs. Reward, Cost	124.983	15.558	<0.001
Cue vs. Reward, Reward	137.673	17.138	<0.001
Cost Cue vs. Reward Cue	11.240	1.399	1.000
Cost Rew vs. Reward Rew	1.450	0.180	1.000

Table S14; Stat Table For Fig. 8**A****Cost Task VTA Latency**Stats used for Figure 8A: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	7	9.384	<0.001
Residual	68		
Total	75		

Comparison	Diff of Means	t	P
Base-1 vs. Cue	0.99	4.29	0.002
Cue vs. Control Cue	1.21	4.812	<0.001
Base-2 vs. Reward	1.07	4.637	<0.001
Reward vs. Control Reward	1.21	4.812	<0.001
Base-1 vs. Base-2	0.01	0.0433	1
Cue vs. Reward	0.07	0.303	1
Control Base-1 vs. Control Cue	0.1	0.37	1
Control Base-2 vs. Control Reward	0.17	0.628	1

C**Bilateral NAcc Cost Task VTA Latency**Stats used for Figure 8C: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	3	9.523	<0.001
Residual	28		
Total	31		

Comparison	Diff of Means	t	P
Base-1 vs. Cue	1.02	3.374	0.013
Base-2 vs. Reward	1.25	4.134	0.002
Base-1 vs. Base-2	0.18	0.595	1
Cue vs. Reward	0.05	0.165	1

B**Reward Task VTA Latency**Stats used for Figure 8B: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	7	9.215	<0.001
Residual	60		
Total	67		

Comparison	Diff of Means	t	P
Base-1 vs. Cue	3.41	5.252	<0.001
Cue vs. Control Cue	2.25	3.362	0.038
Base-2 vs. Reward	3.73	5.745	<0.001
Reward vs. Control Reward	2.61	3.9	0.007
Base-1 vs. Base-2	0.14	0.216	1
Cue vs. Reward	0.18	0.277	1
Control Base-1 vs. Control Cue	0.202	0.293	1
Control Base-2 vs. Control Reward	0.19	0.276	1

D**Bilateral NAcc Reward Task VTA Latency**Stats used for Figure 8D: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	3	12.063	<0.001
Residual	24		
Total	27		

Comparison	Diff of Means	t	P
Base-1 vs. Cue	0.75	3.343	0.016
Base-2 vs. Reward	1.12	4.993	<0.001
Base-1 vs. Base-2	0.23	1.025	1
Cue vs. Reward	0.14	0.624	1

Table S15; Stat Table For Fig. S14

Optogenetics and Motor Chamber

Stats used for Supplemental Figure S14: One Way Anova

Bonferroni post-hoc analysis

Shapiro-Wilk: Passed, p=0.652

Brown-Forsyth: Passed, p=0.714

Source of Variation	DF	F	P
Subject	7		
Time	11	11.152	<0.001
Time x Subject	77		
Condition	1	0.218	0.655
Condition x Subject	7		
Time x Condition	11	0.465	0.919
Residual	77		
Total	191		

Table S16; Stat Table For Fig. S15

Retention

Stats used for Supplemental Figure S4: One Way Anova
Bonferroni post-hoc analysis

Source of Variation	DF	F	P
Between Groups	1	3.811	0.064
Residual	22		
Total	23		